SCIENCE.

FRIDAY, DECEMBER 25, 1885.

COMMENT AND CRITICISM.

ALL AMERICANS have been amused with the stories which have recently appeared in the newspapers, of the intense state of excitement to which the English people have allowed themselves to be roused by the elections just closed. There is, of course, good reason for the difference in American and English election manners in the prolongation of the agony which the protraction of the English elections entails. In the *Lancet* for Dec. 12 appeared an article on 'Deaths from election fever.' The writer takes the ground that the feebler minds of a community are those which take the most interest in politics. "This being so, it ought to surprise no one that a large sprinkling of the 'minds' subjected to the strain and excitement attendant on a general election should give way, or that in a certain proportion of instances brains should be so affected as to suffer those coarser injuries which end in speedy death rather than protracted mental disease." Is this to be accepted as a fair statement of the facts in England, and do we experience in the United States an increase in the number of deaths from brain-diseases at times of great political excitement?

WHILE THERE IS MUCH to rejoice at in the recent circular issued by A. C. Armstrong & company, concerning the *New Princeton review*, yet there is one paragraph that cannot but have a disappointing effect when read by those whose interest in philosophy is purely scientific, and not dogmatic or polemical. It is clearly implied that no philosophical articles, however meritorious, will be admitted into the *Review* unless they are in accord with the system of realistic philosophy, on which the venerable president of the college of New Jersey lays so much stress. From the point of view of science, this is an unfortunate determination. We have in the English language only one really scientific philosophical journal, and that is published in London. The *Journal of speculative philosophy* is excellent in its way, but it is not in the accepted sense of the word 'scientific.' Many of our other periodicals admit philosophical articles, but they are lost sight of amid the surrounding mass of theology, literature, and art. The *New Princeton review* had been eagerly looked forward to as supplying a want, as far as its philosophical department was concerned. Now its preliminary announcement disappoints this expectation. We repeat, that, from a scientific stand-point, it is unfortunate that this new magazine is to be a dogmatic philosopher and an organ, rather than scientific and critical.

MOST OF THE INTERIOR of New South Wales, which is occupied by the watershed of the Darling River, the main line of drainage of the Australian continent, is a great alluvial plain, with little slope in any direction, and no well-defined water-courses in a considerable portion. The fall of the Darling through much of its length is but a few inches to the mile. The soil is of salt or bitter lake formation. The industry to which a large portion of this territory is likely to be devoted is sheep-raising, provided a sufficient supply of water can be obtained without requiring the sheep to travel too long a distance. As droughts occur extending over periods of from one to three years, the solution of the problem of water-supply is vital to the settlement of the country. Since the soil is light and unstable, permanent dams cannot be constructed in the rivers without great cost, and the declivity is too slight to permit of water being conveyed by artificial channels or canals to any distance from the streams. It has been found by artesian borings that some of the beds of loose sand interstratified with the clays yield a large supply of fresh water; but the limited amount of research that has yet been made is not sufficient to assure the squatters that water can thus surely be found, and the search for water by that means is too costly and uncertain a process for the settlers. The construction of storage-tanks, to be supplied by surface drainage, has therefore been suggested. Under the arduous conditions imposed by the probability of long droughts, these earthen tanks should be made much larger than has been the practice heretofore. The smallest reservoir, to supply some eleven thousand sheep, pastured on an area of six miles square, would require the excavation of

10,000 cubic yards, at a cost of $4,000, and would hold 6,750,000 gallons of water. An evaporation of five feet in depth per annum, removing 2,800,000 gallons, would leave 3,950,000 gallons for the use of the sheep, — enough for one year, and perhaps eighteen months. To carry the sheep through a possible drought of three years, a tank of twice the capacity would be required.

IN A RECENT NUMBER of the London *Times* appears more evidence of the interest of England in the conquest of Burmah, that a good trade-route with western China may be opened. After referring to the misguided ways of King Thebaw, who is held up as a weak individual, guided by a few ill-advised ministers of state, the *Times* refers to the future of the country in these words: "Whatever may have been the influences round King Thebaw, they cannot much affect the future of his kingdom. Mr. Bernard, the chief commissioner, will, it is stated, proceed at once to Mandalay, with a party of officials acquainted with the Burmese language. For the present, General Prendergast will administer the country. But when Mr. Bernard arrives, civil authorities will take charge of it, and rule it in the name of the empress of India. The question seems to have been carefully studied, and there seems to be no difficulty in framing a temporary organization for governing Upper Burmah. Our efficient Indian civil service is not to be embarrassed by the acquisition of a new province."

RAILWAYS IN BURMAH.

MR. HOLT S. HALLETT recently addressed the members of the Scottish geographical society, his subject being 'A survey for railway connections between India, Siam, and China.' The conquest by England of Upper Burmah places the Burmese Shan states under her protection, and thus allows their peaceful and trade-loving inhabitants to expect a better commercial connection with that country. England is now placed in such a position that no political hindrance remains to prevent her driving the iron horse up to the gates of China, and opening up to trade the western provinces of that rich and prosperous empire. For the past four years Mr. Colquhoun and Mr. Hallett have deeply interested themselves in the subject of the expansion of trade by linking China and the intervening countries to India by means of railways. The valley of the Irrawaddy is bounded on the west by a range of hills which, as it proceeds southwards, spreads out into an entangled mass, touching the sea along the Bay of Bengal with many of its spurs. No railway can therefore be constructed, except at a prohibitive cost, from Calcutta along the seaboard towards Rangoon. Through the pass used by the Burmese in their invasion of Assam, there is a route which would suit admirably for carrying a railway from the Brahmapootra valley into the valley of the Irrawaddy, and then the railway could be joined, without meeting any great difficulties, to the Rangoon and Tonghoo line, having its present terminus at Rangoon. The height of the pass is not more than 2,500 feet above the sea-level, or 2,000 feet above the level of the Brahmapootra valley.

Owing to the many ranges that would have to be crossed, a railway constructed to connect any part of the Irrawaddy valley in Upper Burmah, or Lower Burmah to the north of Beeling, with western China, would be of greater length and considerably more costly than a line (proposed by Mr. Hallett) which has its terminus at Maulmain.

In considering the traffic which would be likely to arise from the construction of railways through the centre of Indo-China, Mr. Hallett said: "It will be well to remember, 1°, that although the population of our possessions in British Burmah is only 1-40th of that of our Indian dominions, yet British Burmah has 1-10th of the whole trade of India; 2°, that Upper Burmah, which since the rebellion of the Burmese Shan states has scarcely a million of inhabitants, still carries on a trade with us of about £3,000,000 sterling; 3°, that a million sterling of treasure is imported into Burmah each year more than is exported; 4°, that Chinese emigration has been shut out lately from America, Australia, and other places, and would certainly set into the fertile plains of Indo-China if it were encouraged and facilitated by the construction of railways; 5°, that already half the population in the delta of the Meh Nam is composed of Chinese and their descendants; 6°, that the great want of British Burmah is population."

The paying prospects of the proposed railways can be compared with those of the railway between Rangoon and Prome, which was opened in 1878. This railway, which is 162 miles in length, was made to connect the town of Prome with the seaport of Rangoon. It passes for fully two-thirds of its length through an unfertile country covered with scrub jungle. On the whole length of the railway there are not more than six villages, and the line is in competition with the admirable flotilla of steamers plying on the Irrawaddy River. Yet this line paid to the English government a net profit of 6 per cent last year upon the expenses of its construction.

BAD TIMES.

IN these days of many books, one gives a welcome to the man who can write a small book; but in this case the man is he whose work makes him the rival of two not often found together in the same comparison, — Charles Darwin and Henry George. Mr. Wallace, as a naturalist, disputes with Darwin the claim of having originated the theory of natural selection; while, as the defender of the nationalization of land, he also appears in the field where Henry George had been the most prominent figure. Like Simon Newcomb, who has lent the hours not occupied by severe mathematical studies to the service of political economy, so Mr. Wallace has turned from natural history to explain to us the causes of the depression in business which has in the years since 1873 become so unfortunately familiar to us all.

His definition of 'bad times' consists in "the low prices of goods, the number of men out of employment, and the numerous bankruptcies" (p. 14), thus showing the influence of that common failing in business circles wherein men think that high prices are in themselves good, and low prices bad. It is owing to this prevalent opinion that men are apt, even when they know better, to wink at any measure which promises higher prices, even though it be through increased quantities of money. Indeed, our silver dukes hold their vassals in obedience, to no small extent, by making them believe that demonetization of silver leads to a contraction of the world's money, and so to a fall of prices. When a man has a stock of goods on hand, he wants prices to go up, no matter how. This overlooks the fact that money as a medium of exchange is only a means to an end, or a road from one to another place. An increase of money may raise prices, but not the quantity of goods in the world. Doubling the trucks in a store does not double the goods which they are made to carry.

But the real distress from low prices arises from the fact that they once were high; and that obligations to a fixed amount, entered into when prices were high, must now be paid off when prices are lower. This is the painful process; and yet it is painful only because people, led away in the period of speculation by sanguine expectations, entered into obligations which they did not have the actual wealth to satisfy. They bought with an enlarged faith, that is, with an expanded credit; and when the panic came, they found out that they had only expectations, instead of real wealth, with which to meet their engagements. Into this truth our author takes us, with some natural traces of English insularity, by explaining the effect of foreign loans in producing the depression. In 1870–75 he claims that England furnished one thousand three hundred million dollars as foreign loans to Egypt, Turkey, Russia, Austria, Italy, and Spain; to Brazil, Peru, Chile, and Paraguay; and to Costa Rica, Mexico, Guatemala, Honduras, Japan, and the United States; and to English colonies. These loans left England in the form of exports; so that English exports appear to have been so unusually increased during these years, that they have never since been equalled. The effect on England was to unnaturally stimulate many manufactures. "But soon came the inevitable reaction. The vast amounts of borrowed capital were exhausted, and, instead of having a plethora of money to spend, all these countries had interest to pay; and the people being heavily taxed to pay this interest, their purchasing-power was diminished, and the demand for our goods suddenly fell off." These foreign loans being expended so largely unproductively in wars and extravagant uses, nothing remained as a permanent source of demand for England's goods, and so English exports declined, business became depressed, and men were left unemployed. In this chapter our author gets nearer the essential truth than in some other of his explanations of the 'bad times;' for the above conditions were not solely English, or true only of nations. Individuals and corporations were everywhere lending and consuming beyond all wisdom, out of all proportion to their real means of payment. After our civil war, that was what we were doing.

The other causes seem to be of value only so far as they lead up to the one already explained. From 1870 to 1884 "the expenditure of the six great powers of Europe has increased from £345,000,000 to £612,000,000, — an additional burthen of £266,500,000 a year. The population of these six states is now a little over 269,000,000; so that they have to bear, on the average, an addition of taxation amounting to nearly a pound a head, or about five pounds for each family." As this has come about owing to wars, or preparations for war, it explains how the wealth has been consumed unproductively. The author also estimates that *seven millions* of men are involved in producing for this wasteful expenditure, and reminds us of 'John Bull and his island,' when he says that "the moral arguments against war would doubtless be more generally effective if it were clearly seen that always and everywhere its direct and necessary effect is to produce more

Bad times: an essay on the present depression of trade, tracing it to its sources in enormous foreign loans, excessive war expenditure, the increase of speculation and of millionnaires, and the depopulation of the rural districts; with suggested remedies. By ALFRED RUSSEL WALLACE. London, *Macmillan*, 1885. 16°.

or less depression of trade." Seize an Englishman by his pocket, and you can convince his mind.

The flow of the rural population to the cities is pointed out as one of the causes of the great distress in the centres of population, because of the vastly greater competition for employment. Together with this movement he instances the fact that "from 1873 to 1884 the quantity of arable land in the country has decreased by considerably more than a million acres." These seem to be local causes, and have little effect on other nations; for they are probably the evidences of a re-adjustment of industries to new conditions, such, for example, as the great produce of American wheat districts. The ownership of land by great millionnaires, he argues, also works injury. In 1863–72 the fortunes above a quarter of a million were 162, but in 1873–82 they had increased to 208, — an increase of more than 30 per cent. But we do not regard these causes of general importance.

The book, in fact, only in its description of the evil effects consequent on speculation, and the mania for foreign loans, gets close at the real cause. But when he gets to his remedies, he does not hit very near the mark. As foreign loans, he thinks, are made chiefly for the glory of monarchs, and to aid in wars for the personal aggrandizement of ruling families, he would have England stand ready to aid the tax-payers in these borrowing countries whenever they revolt against the heavy taxation caused by the loans which they have had no share in spending. Speculative transactions he would discourage by high stamp-duties; and large fortunes should be prevented by a graduated income-tax. If our author were to extract the ever-springing sanguineness of human nature from the business-man, he would best prevent over-trading and the recurrence of periodic panics, but in scarcely any other way.

NIMROD IN THE NORTH.

In this book Lieutenant Schwatka has given a most entertaining story of hunting and fishing in the north polar regions. Seven chapters of the book have been devoted to stories of adventure with animals whose homes are within the arctic circle. Many of the stories told in the volume are similar to some found in the writings of Gerard de Veer, of the Barentz expedition; in the writings of Parry, Beechey, Hearne, Rink, Richardson, Rae, Kane, McClintock, and Hall; so that they are not entirely new; but Lieutenant Schwatka has added to them many interesting observations of his own, upon the haunts and habits of the land and water game of the regions he explored, which modify ideas derived from other writers.

The volume is illustrated with numerous faithful and lifelike pictures of the animals, birds, and scenery of the regions beyond the parallel of 66° 30′ north. This feature of the book will make it most attractive to the reader, but more especially to the younger generation, who will find much pleasure in having before them such excellent representations of the bear, reindeer, musk ox, walrus, etc., with which Lieutenant Schwatka's party had so many exciting and perilous adventures during their stay in the country between Depot Island and King William's Land.

The story of the sledge-journey to King William's Land, as told in this book by Lieutenant Schwatka, is unparalleled in arctic exploration. The vicissitudes of storm and intense cold encountered and overcome are most interesting and instructive. To one of less determination or of less hardihood, the journey must have failed; but the indomitable will and inexhaustible self-reliance set forth in the story made success certain where failure would have likely occurred to any one less gifted.

It is almost inconceivable that travel could have been practicable in a temperature of 83° below the freezing-point, or that no discomfort was felt at such times. But the credence of arctic explorers will be tested almost to its elastic limit, to believe that Lieutenant Schwatka's party, when in chase of musk ox, travelled at 'a good round dog-trot from nine in the morning until four in the afternoon,' making about forty miles in a temperature of 97° below the freezing-point, without suffering from the cold, but, on the contrary, that he felt at times uncomfortably warm!

The last two chapters describe the beginning and ending of a rather remarkable raft-journey of thirteen hundred miles down the Yukon River, in Alaska. This trip led to the discovery of several rapids, the passage of which was full of innocent adventure; otherwise there is but little in it to excite interest.

Nimrod in the north. By Lieut. Frederick Schwatka. New York, *Cassell*, 1885. 8°.

GEOGRAPHICAL NOTES.

Explorations in central Asia. — A letter has been received from Prjevalski, from which it appears that the Altine chain extends about 360 kilometres westward from Lobnor, then gradually declines, and terminates at the Cherchèn River. Westward from this point the principal range of the Kuenlun looms over the plains of eastern Turkestan. This intrepid explorer, after having explored all of the Kuenlun between the Yellow

River and the town of Khotan, was expected, and has probably arrived before this, *via* Aksu and Karakol, at Semirechinsk, the authorities of which district had received a call for forty camels to carry the collections made by the party.

Return of Lieutenant Allen.—Lieutenant Allen, of the Copper River expedition to Alaska, has arrived in Washington, where he will prepare his report.

Cameroons district, West Africa. — Rogozinski writes of the Cameroons district, West Africa, and especially of the elevated region or hill district, which has a relatively good climate when compared with that of the lowlands adjacent. The diurnal variation of temperature is rather large. At Likumbé, 2,500 feet above the sea, the morning temperature was 65° F.; at noon, 88°.5; and at evening, about 73°.0. At the coast, for the same hours, it was 79°.0, 84°.0, and 80°.0, respectively. Often on the mountains during the night the cold was quite sensible, the thermometer falling to 60°, and rising at mid-day to 87° or 88°. The principal languages of the hill country are the Bakwiri or Bakwillé, Bamboko, Isubu, and a jargon spoken at the coast. This is the most northern outpost of the Bantu family on the west. The dialects are all nearly related to the Dwalla, spoken on the Cameroons River. The villages are not composed of associated huts, as might be supposed. Generally the cabins are scattered through the chaparral, not more than two together. A certain number form a clan or group, with a chief and several elders as the government. The men are hunters, and gather palm-oil and rubber: all else is left to the women and children. They do not give their confidence easily, but when once given it is easy to guide them. Their game does not include the elephant, common in that vicinity, and rarely the leopard. The women gather plantains, ignamas, nuts, palm-oil, etc., which constitute their chief sources of subsistence. The little plantations are managed by the women and children. The soil is extremely fertile and productive. The real richness of this land is for agriculture. The houses are built of canes, and covered with mats. The domestic animals, including pigs, sheep, goats, and fowls, have free access, so that they are far from clean. Snakes, iguanas, and the small meagre dog of the country, are eaten. Slavery does not exist, but polygamy is allowed. The people are quiet, except for *vendettas*, which are the source of many small conflicts and most of their ills.

Trade-routes between Bolivia and the Argentine Republic. — The observations of Thouar in the region of La Gran Chaco have been renewed. The traveller has especially in view the establishments of trade-routes between Bolivia and the Argentine Confederation,— an object of much importance to both countries, and to commerce in general. The emperor of Brazil is also very much interested in any thing tending to improve communication between the interior countries. Thouar accepted an escort of twenty-five men with equipment, and left Buenos Ayres, July 31, accompanied by Lieut. Felix Guerber and Pilot Wilfrid Gillibert. They were about to enter the north Chaco, to trace its unknown portion and complete the charts, when last heard from. Just as they started, Thouar was informed that a party, under Ernest Haugge, engineer, of German birth, and a Bolivian escort, engaged in studying the route between the Sucre and the upper Paraguay rivers, had disappeared in the Chaco, having been carried off by the indomitable Tobas.

Colonization in the Argentine Republic. — Colonization in the Argentine Republic seems more flourishing than in other parts of South America. Some five to twenty colonies have been established in the Santa Fé district, occupying about 95 square leagues, which a few years ago were given over to the Indians. To-day they are cultivated by 1,359 families. A railway leaves Santa Fé, and traverses this region; another is projected from Rosario. The soil is of great fertility, and but little more than energy and good will are needed to acquire here, if not a fortune, at least ease and comfort. The district of Santa Fé has received 88 colonies during the last 30 years, and now has over 110,000 inhabitants.

An island lost, and another found. — The rock known as the Monk (Munken, Monaco, etc.), six kilometres southward from Suderö, Faroe Islands, has succumbed to the elements. This rock, some seventy feet high, and from certain points of view sufficiently resembling a cowled figure, was described by the earliest writers on the Faroes, and has served as an important landmark for navigators for hundreds of years. A dangerous reef, nearly covered at high water, alone remains to mark its former position. In contrast to above is the important communication recently received by the Merchants' exchange of San Francisco from our consul at Apia, Samoa, announcing the upheaval of a new island in the track of vessels from California. This island was estimated by the officers of the steamer Janet Nicol as two hundred and fifty feet high, and two miles long north by west and south by east. The steamer approached to about a mile and a half from the crater, bearing west by compass. No bottom was found here at one hundred fathoms, but reefs extend from the extremities of the island, about a mile and a half in either direction. The locality

in a general way is off the Celebrass shoal, about forty miles from the Tonga Islands, toward the Fiji Islands. Its position is approximately in latitude 20° 28′ south, and longitude 175° 21′ west from Greenwich. Further details are expected by another steamer. The island was photographed by the British consul to Samoa, who was a passenger.

ASTRONOMICAL NOTES.

Harvard college observatory.— Professor Pickering's annual report was presented to the visiting committee on Dec. 3, and shows most gratifying progress in the work, in spite of the serious curtailment of the income of the observatory during the past year. The fifteen-inch equatorial is still devoted largely to photometry ; and, besides a large amount of routine work accomplished, a series of observations of the temporary star which recently appeared in the nebula of Andromeda was obtained. Professor Rogers's excellent work with the meridian circle continues, and the reduction of his zone is nearly ready for the press. The meridian photometer also has been in active operation. By the aid of the Bache fund an important investigation has been undertaken in stellar photography, which has already been referred to (*Science*, vi. 443). Mr. Chandler's work with his almucantar we have noticed from time to time, and we look forward with much interest to the publication of a detailed description and theory of the instrument, which it is understood he has prepared. The telegraphic distribution of important astronomical discoveries, for which this observatory is the American centre, has been successfully continued under the supervision of Mr. Ritchie.

The Lick observatory.—The Clarks have made wonderfully rapid progress with the crown-glass disk of the immense three-foot lens for the Lick observatory. The work of grinding was begun on the crown-disk about two months ago, and already they are able to set up the lens for examination by artificial light. The flint-disk has been practically ready for some time, and, with continued favorable progress, they hope to finish the objective by the autumn of 1886. It has not yet been decided who is to make the mounting for the instrument, or the dome which is to cover it. We notice that the thirty-inch objective for the Nice observatory has just been finished by the Henry brothers, and that it has been sent to M. Gautier, who has charge of the construction of the equatorial; the whole to be mounted at Nice in April, 1886.

The Biela meteor-shower. — Reports from Europe show that we in this country entirely missed the thickest part of the meteor-shower of Nov. 27, as it had dwindled to comparatively insignificant proportions when our twilight came on. From various places in England and on the continent, where the sky was clear on the 27th, come reports of brilliant showers, sometimes too rapid for counting, and in many cases exceeding sixty per minute for a single observer. They were also very bright, and left trains continuing visible in some cases as long as 30^{s}, and frequently appeared almost simultaneously in bunches of five, eight, or ten. These were all early in the evening for European longitudes, and we shall have to wait for reports from farther east, in Arabia or India, perhaps even from Dr. Doberck at Hongkong, before we can be sure that we have heard of the maximum activity of the shower. This seems to have been well heralded in advance. The earliest observations thus far reported are by Mr. Barnard of Nashville, Tenn., who observed twenty or thirty meteors from the Biela radiant during an interval of two or three hours of clear sky on the evening of Nov. 25 ; and both he, and Mr. Denning of Bristol, England, counted them at the rate of one hundred or more per hour on the evening of the 26th. On the 27th none of the comets in this country appear to have exceeded two hundred or three hundred per hour for a single observer, and Mr. Denning reports that those of the 28th were very small and insignificant in a clear sky at Bristol.

New star in Orion.—A complete set of observations of the new star discovered by Mr. J. E. Gore, an English astronomer, on Dec. 13, was obtained at Harvard college observatory on Dec. 16, — the very evening on which the despatch was received from Lord Crawford, — settling the non-identity of the star with D.M. + 20°, 1172, the star named in the despatch. A meridian circle observation by Professor Rogers gave for the position of the *nova* R.A. 5^{h} 49^{m} 4^{s}.25 : Dec. + 20° 9′ 15″.6. Professor Pickering's photometric measures made the magnitude 6.2, and the spectroscope showed the existence of bright bands. Two excellent photographs fixing the position of the star with reference to neighboring stars were obtained, and one photograph of the spectrum. The indications are suggestive of the new star being a long-period variable, and there was a slight suspicion of a diminution in magnitude during the first six or seven hours it was under observation.

METEOROLOGICAL NOTES.

An unusual tornado. — The Alabama weather-service report for November describes the tornadoes that occurred on the 6th of that month. At Decatur the storm is reported to have come

from the south-east, a very unusual direction for tornadoes. The report concludes with a well-emphasized note.

Meteorology in New England. — The Bulletin of the New England meteorological society for the same month is based on reports from 136 observers. The precipitation is found to be 0.96 inch more than the average for ten or more Novembers at 31 stations, and the temperature is 2°.5 above the average. Storms on the 1–3d, 5–9th, and 22–29th, were the chief disturbances of the month. Wind-velocities by anemometer record are given for thirteen stations. Blue Hill had a maximum velocity of 65 miles an hour from the south-east during the storm of the 25–26th, with a total run of 15,389 miles for the month. The Eastport, Boston, and Block Island records for the same are 45 and 8,513, 46 and 9,338, 47 and 13,344, respectively. The tides during the last of the three storms were very high, owing to the concurrence of strong easterly winds, with the time of new moon and the moon's nearest approach to the earth. An increase in the number of stations around Brattleborough, Vt., is noticeable on the map.

Prediction of tornadoes. — A lecture on 'Tornado study' was recently delivered before the Franklin institute in Philadelphia by Lieut. J. P. Finley of the signal office. Probably no one in the country is more conversant with the facts and features of tornado occurrence than Lieutenant Finley, who has made a special study of these destructive storms for a number of years past. Their peculiar characteristics were described, and an account was given of the fifteen hundred volunteer tornado reporters who observe and report on these storms in all parts of the country, according to a plan devised by Lieutenant Finley. It was also announced that predictions of tornadoes are now attempted successfully, although they are not yet published. A dangerous attitude of weather conditions for the eastern middle states was recognized in the morning of Aug. 3 last, and in the afternoon tornadoes occurred at Philadelphia and thereabout.

Cold waves. — A signal-service note, xxiii., is a preliminary study of 'Cold waves and their progress,' by Lieut. T. A. Woodruff. They are found to follow an area of low, and to precede an area of high pressure, but their cause is not considered. Within our territory they nearly always appear first at Helena, Montana, and it is concluded that "they have their origin in the vast regions of ice and snow near the arctic circle far to the north of our stations." It is possible that records from the British north-west territory might disprove this conclusion; for in the winter, when the cold waves are most frequent, it is not always the polar regions that are coldest. The waves are found to move in different ways: 1°, directly eastward, over the great lakes and across New England, not being felt south of the Ohio valley; 2°, south-easterly, covering the entire country in their progress; 3°, southerly, from Montana and Dakota to Texas, thence through the Gulf states, and finally north-eastward over the Atlantic states, such waves being sometimes felt at St. Louis and Shreveport before reaching St. Paul and Chicago. The number of waves belonging to the three classes during the first six months of the years 1881 to 1884 was 22, 47, and 19. The second class thus appears more frequently than the other two combined. Fifty per cent of the waves appeared simultaneously at Bismarck and Helena. They generally reach Omaha eight to sixteen hours after their appearance at Helena, the distance being 880 miles; St. Louis, 24 to 32 hours, distance 1,030 miles; Galveston, 24 to 40 hours, distance, 1,600 miles; Nashville, the same; Buffalo, 24 to 48 hours, distance 1,750 miles; Washington, 32 to 56 hours, distance 1,953 miles. The difficulty in the prediction of the waves is the same that embarrasses the prediction of storm-centre tracks, for the former follow the latter. There has as yet been no tabulation published by the signal office of the conditions attending the early appearance of areas of low pressure, which afterwards take different directions in crossing the country. A special description is given in the note of the cold wave of March 18, 1883, in which the fall of temperature in twenty-four hours was generally 20° to 40° over the country. The most marked falls of temperature follow well-developed storms, and accompany an area of abnormally high pressure.

NOTES AND NEWS.

UNDER the will of the late Henry N. Johnson, and by the death of his widow in February, 1885, the Academy of natural sciences of Philadelphia, named as residuary legatee, has come into the possession of his entire estate, valued at $51,761.40. The present annual income from the productive portion, less taxes and water-rent, is $1,434.82.

— In many respects this is a golden age for children. This is true in the matter of school-books no less than in children's literature. In the 'new eclectic series of geographies,' Van Antwerp, Bragg & Co. have attempted to make the elementary study of geography attractive to children, and presumably with success. Their 'Complete geography' is excellent in its fulness,

its arrangement, in the satisfactory manner in which physical phenomena are described and explained, and in its general accuracy. Their 'Elementary geography' is equally well adapted to infantile minds. The illustrations of both editions are well selected, and are beautifully executed. The maps are modern, and are well adapted to the purposes of instruction. On the whole, the orography — the element with with which map-makers have the most difficulty — is fairly, and in some regions excellently, expressed. The registering of the colors on the maps can be very much improved.

— Dr. Daniel G. Brinton of Philadelphia has been announced as laureate of the Société américaine de France for 1885, and has been awarded the medal of the society for his works on the aboriginal languages and mythology of America.

— At about 10.12 P.M. on Dec. 10, a sharp shock of earthquake was felt in Victoria, B.C. It resembled the rapid roll of a heavily laden truck along a paved street. The vibration lasted from ten to fifteen seconds. At New Westminster the shock was felt at precisely the same time, but lasted about forty seconds.

— An atlas of Japan, in seven sheets, is announced by Justus Perthes. Each sheet will be on a scale of 1 : 1,000,000, and the atlas will be accompanied by a sketch-map on a scale of 1 : 7,500,000. Four of the sheets have already appeared, and the others will be issued during the coming year.

— The new balloon constructed by the Meudon aëronauts will be directed, says *Nature*, by a steam-engine, as advocated by M. Henry Giffard. Electricity will be quite given up, owing to its want of power for continuous action. From the reports to be published in the next number of the *Comptes rendus*, it appears that a velocity of six metres per second was obtained.

— Mr. Gaurel, at whose sole expense the late expedition to the Kara Sea, under Lieutenant Hovgaard, was undertaken, intends, provided his enterprise be seconded by the government, to send his steamer Dymphna next summer on an expedition, under an officer of the Danish royal navy, to the east coast of Greenland to explore and lay down the coast-line between 66°.08, the farthest northward point attained by Captain Hohn's expedition, and 70°.

— On examination of the extensive series of stellar photographs obtained at the Harvard college observatory, it appears that on Nov. 7, 1885, a photograph was taken of the region in which the new star is now visible. The star does not appear upon this photograph, which shows that at that time it must have been at least half a magnitude fainter than at present.

LETTERS TO THE EDITOR.

What has the coast survey done for science?

The contributions of the coast survey to general scientific knowledge in America may be said to begin with the year 1844, when Prof. Alexander Dallas Bache succeeded to the superintendency, on the death of Mr. Hassler, in December, 1843.

Mr. Hassler had given all the active energies of his life to a successful inauguration of a work of which few but himself realized the extent, or had any idea of what was implied in a 'survey of the coast of the United States;' and he came from Europe to this country at the beginning of the present century, when our country was still barely recognized among nations, and its few and ablest men were too much engaged in meeting and solving the practical problems of existence for the nation generally, and for themselves individually.

The number of men at that time who had made their mark as original investigators and thinkers in the different branches of astronomy, chemistry, mathematics, and physics, were so few that they might be counted upon the fingers. A few of the associates of the illustrious Franklin, among them Rittenhouse, Ellicott, and some others of the American philosophical society of Philadelphia, were joined by others from abroad — men like Priestly and Gallatin — in correspondence with men of like pursuits in England, France, and Germany, and were slowly and quietly laying the foundation for the building-up of a spirit of scholarship and physical inquiry, which rapidly developed after peace came finally to the country, in 1845, producing such men as Bowditch, Nicollet, and many others.

Mr. Hassler came to this country accredited as a man of learning and ability by the French academy. Being a native of Switzerland, he became intimate with his countryman, the eminent statesman Albert Gallatin, who was at that time secretary of the treasury under President Jefferson. The President had himself been given greatly to philosophic studies, and had, while resident in France, been the companion and friend of many of the most eminent men of science in that country.

It was through Mr. Gallatin's active and powerful aid that the idea originated by Mr. Hassler, of a great general 'survey of the coast of the United States,' was brought to Mr. Jefferson's notice, and his powerful aid secured in obtaining the passage of the act of February, 1807, which is still the legal basis of its existence.

Obstacles of various sorts arose in the way of carrying the act into execution. Chief among them was the war of 1812–15 and its consequent debt, crippling the means of the nation. Started in 1816, it was shortly after transferred to the navy, where it languished until, in 1834, it was re-transferred to the treasury department, where it has ever since remained.

The principle of organization adopted (and still adhered to, so far as practicable) was carried forward by Mr. Hassler under many difficulties, which were brought to the notice of congress, and resulted in the reference of the whole subject to a committee of

investigation, of which the late Hon. Caleb Cushing was one of the principal members. The result was "legislation creating a mixed board, from the coast survey, army, and navy, which adopted the plan of re-organization," in 1843. This, on approval of President John Tyler, had the force of law, and under it the survey has been conducted. The following extract from the report of the superintendent for the year 1849 describes the practical working of the system: —

"The re-organization of the coast survey, under legislative authority," in 1843, embodied all the experience obtained up to that date, both of trials which had succeeded, and of others which had failed: it confirmed and gave the force of law to the union in our corps, which has gradually grown up, of civilians, officers of the army, and officers of the navy, serving under a neutral department, under which alone they could be united; namely, that having control of matters relating to commerce and navigation. It is easy to see, that, without a permanent (civil) nucleus for such a work, the objects and aims must be wavering and unsteady, the methods wanting in uniformity from year to year and from party to party, and the results heterogeneous in kind and in form. Confusion and waste would result from such an organization, and the survey would in time be abandoned. The scientific parts of such a work require diligent study and devotion to mathematical and physical science, to grasp them in their various bearings; and it is not too much to say, that, unless such a work came up to the demands of science and the scientific men of the country, it could not long stand. That the theoretical knowledge acquired at the military academy should be reduced to practice in the survey by those officers of the army who have an inclination to similar pursuits, to its advantage as well as their own, will readily be seen; and, up to the point where details would interfere with the duties of the arm to which the officer belongs, congress has conferred upon the work a right to seek his services. The war department judges whether they can be properly granted or not.

"The law of 1843 very properly limited the services of the officers of the navy to the hydrographic parts of the work, — the portions which have a professional bearing, and towards which the inclination of a nautical man may turn with professional pride. Experience has fully shown the advantages of this organization in general. The tendency resulting from the variable elements (the army and navy) is nevertheless, at times, to lessen the results produced by the necessity for turning aside from actual work to give instruction, and from the loss of the experience acquired at the expense of the survey by the removal of officers — caused, no doubt, by the exigencies of their proper service, and yet reacting severely upon the survey. The experience and knowledge of Humphreys, Johnston, and Prince, of the army, and of Davis, Patterson, and Porter, of the navy, cannot readily be replaced: a detail may be filled, but the knowledge immediately available is not supplied."

Mr. Hassler died in December, 1843, just as this system went into operation. He had never realized the enormous advance which the country had made in every department of industry and learning in the thirty-six years which had gone by since the passage of the law of 1807. To his mind we had then to look abroad not only for all appliances for scientific research, but also for the men to use them. The late Mr. Thomas McDonnell, so long in the coast survey, informed me, that, so late as 1836 and 1837, he was the only man in Mr. Hassler's party who habitually spoke the English language. But in that period Bowditch had risen to the zenith of his reputation; men like Peirce, Henry, Bache, Walker, Morse, and many others, had come forward, and placed American science upon the enduring basis which has ever since been maintained and extended.

From among these eminent men, Professor Bache was selected, by almost unanimous consent of the learning of the country, to succeed Mr. Hassler at the head of a work then recognized as the greatest, as it was almost the only, scientific work of the country. The pressure upon President Tyler for his appointment was so great that he was obliged to yield to it, although he was opposed by the then secretary of the treasury, Hon. John C. Spencer, who preferred another person, but who soon recognized the remarkable fitness for his position shown by the new superintendent, and in less than six months became his firm friend and supporter.

From this time forward the work of the coast survey was rapidly extended; its increased usefulness was recognized by congress by steadily increasing appropriations, as the work was extended to all parts of the coast. Between 1844 and 1849, or in the short period of five years, the extent of the coast line of the United States was doubled by the addition of Texas, and the Pacific coast from San Diego to Vancouver. But such was the elasticity of the wise method of organization formulated in 1843, that the work expanded to meet the calls upon it, and surveying parties were upon the shores of Texas in 1847, and in California in 1849. The history of the work from that time forward, and during and since the civil war, has been one of which every man connected with it has reason to be proud. It has been foremost in every matter connected with the interests it has had in charge. It has won the approbation, freely and officially expressed, of every enlightened government of the civilized world.

In 1872, for the first time, its work was extended to the interior, and it was recognized by law as the 'coast and geodetic survey.' Other scientific works have been authorized, and some of them have appeared to come in conflict with the duties assigned to it, and seeming to belong to it. With these it has sought or shown no conflict, but has freely rendered to them every possible aid in its power. This is not the place to discuss or further allude to these points. The historical *resume* here given, of the early inception and progress of the work under its most renowned chief, has been necessary to a proper understanding of the matters now to be brought forward in answer to the question asked me, 'What has the coast survey done for science?' to which I now attempt a reply.

Longitude.

In 1844 the difference of longitude between any point in Europe and any point on this continent was uncertain. Then, as now, the meridian of the Royal astronomical observatory at Greenwich, England, was the reference-point from which longitude was reckoned by English-speaking nations.

One of the first matters taken up by Professor Bache was to obtain a correct difference of longitude between Greenwich and some central point in the United States connected with the survey of the coast.

The services of the best American astronomers were enlisted in collecting and reducing all astronomical observations bearing on the matter. Measures were at once taken for obtaining a different and better class of results by transportation of chronometers on the Cunard steamers between Liverpool and Boston. This method so far superseded others, that it led to the final adoption of the observatory at Cambridge, Mass., as the point of reference for all coast-survey longitudes. Its director, Mr. W. C. Bond, also had charge of all chronometers used in the Cunard steamers.

While this was in progress, other observers at Philadelphia and elsewhere made and reduced observations of occultations and moon-culminations for the same purpose. These observers did not belong to the survey, but were paid small sums for copies of their observations and reductions. By this means the coast survey, under its enlightened head, assisted in bringing forward many men who have since become well known, but who were held back for lack of pecuniary means and instruments, both of which were supplied by the coast survey.

The Morse telegraph had just come into use in 1844. Its application to the purpose of determinations of exact differences of longitude was suggested by Professor Bache to the famous inventor before even the success of the telegraph itself had been commonly accepted as secure. Experiments were made in 1845 and 1846 as soon as lines were established, and in 1846 the first recorded observations were made between Washington and Philadelphia. The ease and precision of the method attracted the attention of all American astronomers, and all attempts at improving it were fostered by Professor Bache. Each year brought improvements in the methods of observing and recording, and greater precision and refinement in the character of the results. First came the disk of Professor Locke of Cincinnati; next that was improved upon, and the clock-beats by telegraph rendered automatic by Prof. O. M. Mitchell, by which an astronomical clock in Cincinnati was made to beat and record its time both audibly and graphically in other and many distant places at the same moment. Finally the invention and perfecting of the 'chronograph' brought the whole to its present state of perfection. As soon as the Atlantic cable became a success, in 1866, it was at once employed by the coast survey to obtain a precise difference of longitude from Greenwich, and this was repeated at three different periods and by different cables and observers in 1870 and in 1872, with an extreme discrepancy of only five-hundredths of a second of time, leaving nothing further to be desired. In 1852, on the death of Assistant S. C. Walker, Prof. B. A. Gould succeeded him as assistant in charge of telegraphic longitudes at intervals until his resignation in 1868. During this time the development of the method was carried forward by him with his usual zeal and energy. His last great work was the inception and execution of the first telegraphic determination of longitude from Greenwich through the cable, then just laid, in the fall and winter of 1866. The difficulties then encountered and overcome (much greater than in any subsequent expedition) are fully detailed in his elaborate report, printed as appendix No. 6 to the coast-survey report for 1867.

There have been printed between 1846 and 1884, by the coast survey, 26 reports on astronomical methods of determining longitude, 8 reports on chronometric methods, and 30 on telegraphic methods; in all, 64 papers, by Peirce, Walker, Bond, Gould, and Hilgard, being a larger mass of contributions to our knowledge of this important practical and scientific question than has been made by any other one nation within the same period.

This application of the telegraph to the determination of one of the two most important geographical problems known to science has completely revolutionized all previously known methods. It is in use all over the civilized world, and is everywhere known as 'the American method.' It was begun, and has been brought to its present state of perfection, by the coast survey.

The Gulf Stream.

The exploration of this 'river in the ocean' was commenced in 1844, and has been continued ever since under coast-survey direction. Apparatus was used for obtaining temperatures at such depths as could be obtained. In 1846 the separation of the Gulf Stream into two branches was discovered, and was dearly paid for by the loss of a brilliant officer of the navy, brother of Professor Bache, who was swept from the deck of the vessel he commanded in a storm off the coast of North Carolina. The surveys have been kept up and continued, as means have been afforded, from that time to the present.

The ingenuity and skill of the naval officers who have been at different times attached to the survey have resulted in improvements of means and methods, until depths exceeding five miles have been reached; and it has been satisfactorily shown, that, underneath the warm surface-water of the Gulf of Mexico and the Gulf Stream, the temperature of the water steadily diminishes until it is nearly ice-cold at the bottom. The inventive genius of Commanders Bartlett and Sigsbee, U.S.N., while engaged in this duty under Superintendent Patterson, has left little for their successors to do but to follow in the way they have marked out.

Early in this work, or before 1850, the enlightened and liberal view taken by Superintendent Bache, of his obligations to science, led him to take up an apparently different department of science in authorizing dredging to be executed at great depths, that the nature of the inhabitants of the deep sea might be ascertained. This gave to America as a citizen one of the most eminent naturalists of the world. The late Prof. Louis Agassiz has left on record his statement that his determination to become an American citizen was decided on in consequence of the enlightened liberality of Prof. A. D. Bache, superintendent of the U. S. coast survey, in offering him the facilities afforded by the surveying parties and vessels of the work for conducting his investigations upon the Atlantic and Gulf coasts. The magnificent models of the bottom of the ocean in the Bay of North America and the Gulf of Mexico, made under direction of Professor Hilgard, and that of the Caribbean Sea by Commander Bartlett, U.S.N., are results of the long-continued, earnest, and effective labors of the various parties of the coast survey, and the ingenious efforts of the officers of the navy, on coast-survey service, who commanded them.

Tides and currents.

Systematic observations of tides and currents were begun in 1844; and in 1845 the very difficult problem of tides in the Gulf of Mexico, where only one tide

occurs in each twenty-four hours, was attacked. Staff-gauges were first used, but were shortly supplemented by an ingenious self-registering gauge, invented by Mr. Joseph Saxton, of the weights and measures office, by which a continuous automatic record of the rise and fall, with effects of winds and storms, was kept up. These were gradually multiplied by similar instruments at carefully selected points along the coast, until, in 1854, sufficient data had been collected and reduced to form a theory on which was based tables of predicted tides for every day in the year, and for all principal ports upon the Atlantic and Gulf coasts. This contribution of the coast survey to the practical necessities of navigators has been continued and gradually improved up to the present day, and large editions of these little books are yearly printed and eagerly sought for. Similar tables for the western coast, founded on similar observed data, were first published in 1870, and are also continued.

A very considerable contribution to science occurred in 1883, when the tide-gauges of the coast survey at San Francisco, Alaska, and Honolulu, all indicated upon their automatic record the effect of the great earthquake at Krakatoa, in the Straits of Sunda, full one-quarter of the circumference of the globe from the nearest tide-gauge. These earthquake-waves, greatest at Honolulu, continued to impress themselves upon the records for between four and five days. Photographic copies were sent to the Royal society at London by their request.

Another contribution to science in this department has been the invention and daily use, in the coast-survey office, of a tide-predicting machine, which, being set to represent certain elements obtained by not less than a yearly observation at any place, will, by simply turning a crank, predict the times and heights of future tides at that place for the ensuing year. This invention is by Prof. William Ferrel, formerly of the coast survey, and now of the signal service.

Physical hydrography.

Tidal currents, and the laws governing them, have been studied, and the best methods of so controlling them as to aid navigation by deepening channels have been applied in all parts of the Atlantic and Gulf coasts; the basis of action being the coast-survey maps, and the organization of each commission appointed to advise the best action being precisely that of the coast survey. Such commissions have acted, with the most useful effect, in Portland, Boston, Providence, New York, Philadelphia, Wilmington, N.C., Charleston, Savannah, and other places. In all cases the commission has consisted of one engineer officer of the army, one naval officer, and one coast-survey officer. Usually the naval officer has been one who had several years of experience in hydrography upon the coast survey.

Prof. Henry Mitchell, an assistant in the coast survey, has made physical hydrography his special study, and has become one of the recognized authorities upon the subject in this country. He is, and has been since its formation, a prominent member of the Mississippi River commission. Of the one hundred and seventeen publications by the coast survey on the subject of physical hydrography between 1845 and 1883, twenty-seven are by Professor Mitchell, and all have a direct bearing upon the best methods of improving the commerce and navigation of the principal ports and navigable thoroughfares of the Atlantic and Gulf coasts.

Magnetic observations.

In the early surveys of this country, the compass, with its magnetic needle, has been the principal instrument used. It still continues to be largely used, especially in new settlements, and portions of the country where land is of small value. In more populous portions, where land has become valuable, it is being steadily discarded for instruments of greater precision. As a consequence of its great use, observations to determine the general and local magnetic variation had been made in many places from the earliest period of the country's settlement. As our knowledge of the subject increased, and the laws governing the all-pervading magnetic principle came to be better understood, observations not only for magnetic variation from the true north were increased, but apparatus was invented and largely used for observing the two components of the magnetic force, and obtaining the total intensity with which it acts upon a freely suspended magnet in any locality.

Observations of this character were commenced in the coast survey in 1833, and have been kept up ever since, being vigorously pursued since 1844. Small amounts were also paid to outside observers, and in some cases instruments have been loaned on condition of furnishing copies of their observations. Since Professor Bache's death, this important department of coast-survey scientific work has been in the hands of Assistant C. A. Schott, who has, with indefatigable labor, made it specially his own. He has collected and digested all detached observations from every quarter of North America. The tables and maps prepared under his direction, and published by the coast survey, have been and are more largely called for than any other publications; and the expressions of thanks for and appreciation of the valuable practical aid they have given, have been received from engineers and surveyors throughout the entire country. Seventy-two publications have been made by the coast survey on terrestrial magnetism, of which fifteen are by Professor Bache, and forty by Assistant Schott.

Astronomy as applied to geodetic surveys.

When Professor Bache became superintendent of the coast survey, in 1844, it possessed no instrument for precise determination of latitude superior to a sextant. Lieut. Thomas J. Lee and the writer spent a large portion of the season of 1844 in vain endeavors to obtain reliable results from the larger instruments in its possession, which still remain in the archives to mark the progress made in this branch of 'practical astronomy.' Only one small portable transit instrument for observing time belonged to the survey. As rapidly as possible instruments of a higher order were introduced, and better methods of observation and reduction began. The zenith telescope was introduced. This instrument, invented for a different purpose, had been ingeniously applied by Capt. Andrew Talcott, Corps of engineers, U.S.A., to a method of determining latitude, of so delicate, precise, and simple a character, as to leave nothing to be desired in these respects. Just at that time the British association for the advancement of science had published their catalogue of places of over seven thousand stars, chiefly in the northern hemisphere,

which made Captain Talcott's method easy of application for field use at geodetic stations. Professor Chauvenet says of the zenith telescope, —

"The method of finding the latitude by this instrument, now known as Talcott's method, is one of the most valuable improvements in practical astronomy of recent years, surpassing all previous known methods (not excepting that of Bessel by prime vertical transits) both in simplicity and accuracy."

Soon it was found that observations by Talcott's method, with the zenith telescope, were superior in precision to the places of the stars observed as given in the catalogue. Hence arose a demand for better star-places; and the observatories of the country were called upon by the coast survey to furnish them, the coast survey paying for the labor involved in observation and reduction. The directors of the observatories, finding their instruments and means insufficient for the desired results, applied themselves to procure better; and thus again the coast survey, by the stimulus it gave to astronomical means and methods, added another to its list of aids given to the advancement of American science. As a consequence, in a large part due to this cause and to those mentioned in what has been said respecting telegraphic determinations of longitude, we have at present catalogues of star-places of a degree of precision of the highest order.

In 1867, Assistant George Davidson invented and added to our means an ingeniously contrived instrument for observing both latitude by the Talcott method, and local time as usual with a transit instrument, by one and the same instrument. This 'combination instrument' is now largely and successfully used.

Geodesy.

All contributions by the coast survey to science in this department must, of necessity, be practical in their character, since the principles involved in the application of all geodetic methods are as old as Euclid.

Improvement in accuracy of geodetic instruments of every class, and especially in improving their precision while diminishing their size and weight, has been marked and steady from 1844 to the present time. More precise observations are now obtained with a theodolite having a graduated circle of twelve inches diameter than could be had in 1844 with instruments having circles of twenty-four and thirty inches diameter. When it is considered that these instruments are transported to the highest summits of North America, often upon the backs of mules, it will be perceived what a gain to precise scientific observation is obtained by the diminishing of weight.

The substitution of the observation of directions for that of angles is another gain to science. The change of the problem to be ascertained by observation, from 'What is the most probable measure of a certain angle?' to 'What is the most probable direction of a certain line?' has added greatly to ease of observation, and precision in results.

Methods of determining azimuth, or the angle made by any geodetic line with the meridian of the place of observation, have been simplified and multiplied, and increase of precision obtained, with less labor and in less time.

Wherever it had become necessary to use artificial elevations for geodetic observations, it had been usual in Europe, India, and America, to use repeating theodolites which only required temporary stability, not usually exceeding a couple of minutes at a time. For important primary stations, brick towers were erected; or, if wooden towers were used, they were carefully enclosed to protect them from the sun's action. But in 1868, Professor Peirce, then superintendent of the coast survey, authorized the use of open wooden insulated tripods for supporting the larger direction instruments of the coast survey.

The legs of the tripods were exposed to the full action of the sun's rays, while shaded by light cotton screens from the force of the wind. The motion of the wooden tripod caused by the action of the sun's rays was eliminated from the result by the method of observation adopted. Since that period the largest and most delicate theodolites have been successfully used upon cheap wooden structures in many parts of the country, and money and time saved with no falling-off in precision.

Within the past ten years the old methods in vogue a century ago, of observing upon intensified lights at night, have been renewed, using both magnesium and coal-oil reflector-lamps, and much time has been saved by adding to the number of hours when observation was possible. The precision of the work has also gained by night observation.

Topographical methods have also been improved. The use of the plane-table has been extended, and this unrivalled method of executing precise maps, by making and correcting them upon the ground itself, is now regularly taught in some of our scientific schools, as are other coast-survey methods of observation, reduction, and computation. In every institution of learning in this country, at Cambridge, New Haven, New York, Ithaca, the coast survey has left its impress, and everywhere for good.

The coast survey is as well able to continue its course now as it ever has been. Its officers are as able and zealous as they were twenty years ago. Its form of organization has proved itself well adapted to its needs, and, with some essential changes to cause it to conform more closely to the changed external conditions, it may do the country thorough and vigorous service. It is to be devoutly hoped that the opportunity may be given it to prove what it is made of, and that its force may be more concentrated, instead of being broken up and scattered.

C. O. BOUTELLE,
Asst. U. S. coast and geod. surv.

An old work on political economy.

The last numbers of *Science* brought to my memory the time of 1842, when I studied in Paris, and had, by the request of my father, professor of political economy, to procure for him a large number of books and tracts on political economy. Some of them were very rare, even in the libraries, and I had to content myself with making out a very full and detailed account of their contents. Among them was, 'Traité de l'oeconomie politique, dedié au roi,' etc., by Antoine de Montchretien, seiur de Vateville à Rouen, 1615 pet. 4°. The book was only to be found in the Bibliotheque Mazarine and St. Genieve, not in the Royal library. It was considered very rare The book is interesting, as the phrase 'political economy' is first used in it, and its author considered to be its founder. The book is very interesting, praises Tully and his maxims, and is decidedly strong for protection. There are also to be found in it a number of curious

notices. It states that in a room in the large spire of the cathedral of Strassbourg, then belonging to Germany, was preserved the first press, with which Gutenberg had printed his books.

DR. H. A. HAGEN.

Cambridge, Dec. 20.

Reineke Fuchs in political economy.

It is a pity that the recent discussion in *Science* on political economy should end in a kind of mutual triangular contempt. The questions raised are extremely interesting, and especially in the view which Mr. James seemed to take at first; that is, whether we can consider such questions entirely aside from their effect on human character. So far as the principles of political economy are concerned, is it right to lie, cheat, steal, rob, and murder, provided, of course, that one is not caught red-handed. This seems to be the teaching of orthodox political economy, and it is well to state the result plainly. In Goethe's version of the old story, Reineke was successful, and at last became chancellor of the kingdom. But there remain some sentimental people, generally poets, clergymen, and women, who will not believe in Reineke.

ASAPH HALL.

Washington, Dec. 22.

A new meteoric iron from West Virginia.

Through the courtesy of Dr. H. C. Torrey, U.S. assayer in New York, I have come into possession of a mass of meteoric iron weighing about 240 grams, said to have been found near Charleston, Kanawha county, W.Va. It is evidently a fragment from a larger mass, as on no portion of its surface does it present any appearance of the crust invariably forming the exterior of an iron meteorite.

It belongs to the megagramic order of Shepard (the Grobe lamellen of Brezina's new classification), and closely resembles the Sevier county (Tennessee) iron. Its structure is coarsely granular or crystalline, having distinct rhomboidal crystals embedded in the mass. Thin laminae of schreibersite are sparingly distributed throughout, but not in such a manner as to produce the common type of Widmann figures. When a polished surface is etched, it shows a somewhat tessellated arrangement of the figures formed by alternate bands or blocks of kamacite and plessite; but the blocks are irregular in outline, and somewhat wedge-shaped, with rounded sides and angles. Instead of presenting a homogeneous surface, these blocks seem to be cemented together like those of the Arva iron, the distinguishing features of these two falls being confined principally to two points, so far as relates to their general appearance upon an etched surface: viz., the schreibersite shows conspicuously in stone laminae or blocks in the Arva, and only in scattered thin leaves in the West Virginia; and the former is especially subject to oxidation in spots, while the latter seems to be free from them, and it also receives a higher polish, and shows a little lighter color. It was found in 1883, and other pieces are said to exist in Kanawha county. Its time of fall is not known. The British museum possesses a 2,699-gram mass of iron, stated to have been found in Greenbrier county, W.Va., sufficiently contiguous to Kanawha to imply that both irons may have formed part of the same original mass.

In answer to a description of my iron sent to Mr. Davis of the British museum, Mr. D. expressed the opinion that such was the fact, which is confirmed, in my judgment, by his minute description of the museum iron above referred to, which, like my own, is wholly wanting in any thing like a crust. A further comparison with the Sevier county iron shows a like identity in all respects except in the graphitic content, which seems lacking in the West Virginia masses, but altogether so close in appearance and structure as to suggest that both might have come from one original mass. This inquiry must remain a mere suggestion, not fully to be solved even if the separate analyses should closely agree. It is to be hoped for, and yet possible, that fragments may yet be found showing the natural crusted exterior, and that we may learn whether these fragments were all found at one spot, or at such distances apart as to indicate the bursting in mid-air of an iron meteorite, and the scattering of its fragments over an extended line of flight. Of its chemical constitution and the circumstances of its fall, we are quite ignorant.

S. C. H. BAILEY.

Cortland-on-Hudson, N.Y., Dec. 21.

The English sparrow.

Apropos to the discussion on the merits and demerits of the English sparrow pest, it may be interesting to the readers of *Science* to know a little of the way the bird is viewed in England. The London *Academy* says, "It is hard for a lover of birds to approach the 'sparrow question.' Sparrows are found to do more harm than snakes or tigers. Nature's thieves and vagabonds, they are. This is the verdict of every one who investigates the matter. They drive away birds which do more good, and little, if any, harm. For every noxious insect they destroy, they consume more corn than one likes to calculate. A Cheshire farmer, indeed, estimates the loss to England, due to depredations of sparrows, at £770,-094 in a year, and this loss is on the increase. No amount of sensationalism can find any countervailing advantage. The careful and long-continued experiments of Colonel Russel in Essex show that sparrows do unmitigated mischief, and the experience of our colonies and of the Americans confirms the facts beyond cavil. There is really nothing to be said for the sparrow. He carries destruction with him wherever he goes, and leaves devastation to mark his increase. From every point of view, he must be looked at as the enemy of man. Either he must give way to us, or we to him; and just now his power is such that he seems in a fair way to become here, as he has already become in Australia, a factor in politics.

"The Colorado beetle can never commit such ravages as the sparrow is certain to do wherever he is allowed to go on unchecked. Love him as we may for his personality, he ought everywhere to be exterminated with the utmost vigor, for there is no limit, in the course of nature, either to his reproductiveness or to the mischief which he causes. We in England have little conception of the scourge he has proved to be wherever he has been naturalized in foreign lands. It is none too soon to have the question put before us clearly, for every day its importance must become greater." There may be some points in this that are overdrawn and exaggerated, but the general tenor of the notes shows that the pest is giving trouble in its native home as well as here.

RALPH S. TARR.

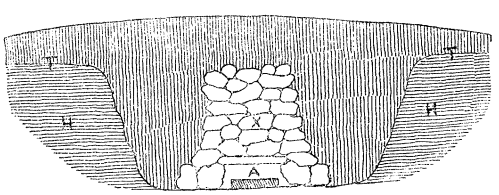
Washington, D.C., Dec. 18.

The Davenport tablet.

As there appears to be a doubt in the minds of many archeologists as to whether these relics should be considered genuine specimens of mound-builders' art, a discussion of their claims to this distinction seems to be demanded.

To do this satisfactorily, a personal inspection of the relics, and a thorough investigation of all the circumstances attending their discovery, should be made. I do not claim to be thus prepared, nor is it my intention to enter at this time upon such discussion; my only object in view in this communication being to call attention to some items in reference to the 'limestone tablet' represented on plate vii., vol. ii., of the Proceedings of the Davenport academy of sciences. The unique and extraordinary character of these relics is calculated, of itself, to raise a doubt in the minds of antiquarians which requires more than ordinary proof of genuineness to render their acceptance as such universal. Examining the excellent albertype of the limestone tablet given on plate vii., vol. ii., of the Proceedings, we are somewhat surprised to see the sun represented with a face; nor is this surprise lessened by finding to the left of the 'hatchet' a regularly formed Arabic 8, made as is customary with writers of the present day, and near the upper right-hand corner the Roman numeral viii. These are not museum marks, as some might suppose, but parts of the original inscription on the stone when found.

The facts regarding the finding, as published by the academy and given by its members, are not calculated to strengthen belief in its genuineness. According to the account given in the Proceedings, (vol. ii. pp. 221–224), the exploration of the mound in which it was found was made by Mr. Gass, assisted by Mr. C. E. Harrison and Mr. John Hume. The account is by Mr. Harrison. The annexed cut is an exact copy of the figure of the mound as given in this account. There was an excavation in the original earth in which was built a pile of stones (*x* in the figure), over which the mound of earth was thrown. This earth was comparatively loose, "easy to handle, being composed of dark soil with some admixture of clay," and there appeared to have been no indications of stratification. At the bottom of the stone pile was a miniature vault covered by a single flat stone. Lying on the clay bottom of this vault was the tablet, as indicated in the figure. This



vault was about thirteen or fourteen inches square, five inches deep, and, with the exception of the tablet (an inch and a half thick), four arrow-points, a little quartz crystal, and a Unio shell, was empty, as appears from this published account; for it is stated, that, "on raising the flat stone, an irregularly rectangular, engraved tablet *was suddenly exposed to view as it lay face up* in a walled vault, evidently built for its reception" (*A* in the figure). But in order to be certain as to this inference, I addressed the following inquiry to Mr. W. H. Pratt, the curator of the museum of the academy: "Was the cavity *A* (fig. 17, *Proc. Dav. acad. sc.*, p. 222, vol. ii) filled with dirt when first observed?" to which he kindly returned this answer: "Mr. C. E. Harrison, who assisted in the work, states that the cavity in which the limestone tablet was found *contained scarcely any dirt* when the flat stone with which it was covered was raised, exposing it to view."

That there should have been an unfilled space in a pile of loose stone in an excavation, beneath a heap of comparatively loose dirt which had stood there for centuries, is certainly most extraordinary.

In a letter now in my possession, written by Mr. A. S. Tiffany in 1882, I find the following statement: "The limestone tablet I am certain is a fraud. Mr. Gass was assisted in digging it out by Mr. Harrison and Mr. Hume. Mr. Hume informs me that there was a wall of small bowlders around the tablet. On the tablet there were some arrow-points, a quartz crystal, and a Unio shell filled with red paint, the whole being covered with a rough limestone slab, *the space between it and the tablet not filled with earth, and the paint bright and clean.*" Mr. Tiffany was one of the founders of the academy, and, as appears from the Proceedings, was long one of its most prominent, active, and trusted local members, and is still a member.

If these statements in regard to the conditions under which this tablet was found be correct, — which we have no reason to doubt, as they appear to agree in all essential particulars, — there are strong reasons for suspecting that it was a plant made by some unknown person to deceive the members of the academy. The simple fact that the little vault under the pile of loose stones was empty, save the presence of the relics, appears to absolutely forbid the idea of age. It is well known to all who have taken any part in excavating, that the water, running down through earth and a pile of stones beneath, will at length fill all the crevices with earth, and in fact all places not hermetically sealed.

It is proper to add here that Mr. Tiffany, in the same letter, vouches for the honesty of Mr. Gass (the finder), who, he believes, was deceived. Speaking of the elephant pipe found by Mr. Gass, which he also thinks was a plant, he says, "It bears the same finger-marks as the first one [first pipe], and Mr. Gass could be deceived with that plant as he was with the tablet. Mr Gass is honest." I have Mr. Tiffany's acknowledgment that this letter, which has been in my possession since 1882, is authentic.

CYRUS THOMAS.

Disinfection.

In my article on 'Disinfection,' published in *Science* of Oct. 16 (p. 330), under the heading 'Sulphurous acid gas,' the statement is made that this agent 'is important for the destruction of spores.' The reverse of this is true, and the sentence should read '*impotent* for the destruction of spores.' Curiously enough, the same mistake has been made by the printer in my article on 'The destruction of cholera germs,' in Dr. Wendt's recent work on 'Asiatic cholera' (p. 332). Both of these articles were published during my absence in Europe, and I had consequently no opportunity to correct the proof. Unfortunately, the printers have made several other serious errors in the last-mentioned article, the chief of which is the substitution of the word 'grain' for 'gram,' on p. 333. GEORGE M. STERNBERG.

Recent Proceedings of Societies.

Naturalists' field-club of Johns Hopkins university, Baltimore.

Nov. 25. — Dr. J. P. McMurrich reported on the work of the zoölogical section. A cruise was made down the harbor, and some interesting marine forms taken by the tow-net, including Evadne, a cladoceran, and a peculiar copepod. —— Mr. W. S. Bailey spoke of the progress made toward completing the geological map of Baltimore, and mentioned the following minerals recently found in the vicinity: malachite and chalcedony (Bare Hills), amethyst (Elysville and Owing's Mills), kyanite and fibrolite in mica schists, on the road between Reisterstown pike and Garrison's lane. —— Mr. F. H. Herrick gave the results of observations made this month (Nov. 14–21) on the vitality of plants as exhibited by their persistence in producing flowers. Within the time mentioned forty-six species of plants were found in flower in the neighborhood of Baltimore. Of these, eighteen belong to the order of Compositae, and twenty, or one-half, are weeds introduced from Europe. The latter were usually the freshest, and produced flowers and fruit in greatest abundance. Of the non-introduced plants, single specimens were commonly found, and those often small or withering. Leaving the latter out of consideration, the late-flowering of the introduced species is readily accounted for. Many of them are perennial in the milder climate of Europe, and consequently, when brought to this country, strive to produce flowers and fruit the year round. Stellaria media, the common chickweed, is a type of this class, and is virtually in flower the whole year. The snow covers in fall its buds and flowers, which expand as soon as the ice melts from around them in spring. This plant was dug from under two feet of snow in mid-winter in Vermont, and, after being placed in water a few hours, its flowers were fully expanded. This explains its phenomenally early appearance in blossom in spring. —— The dispersion of seeds was illustrated by the pods of Cassia nictitans and the 'button-balls' of Platanus occidentalis. The latter tree produces on the average a thousand seeds to each ball, and therefore, in some cases, many millions of seeds; yet it is far from abundant in this and other localities. The oak, which produces relatively so much less seed, is the prevailing tree in this region. The sycamore belongs to an ancient type, the same genus being found among the fossils of the Laramie group. The conditions for its abundant growth are apparently less favorable than formerly. —— Dr. Barton spoke of the bursting of the pods of the Wistaria, comparing the sound produced to a pistol-report.

Calendar of Societies.

Philosophical society, Washington.

Dec. 5. — Annual address by the president, Asaph Hall; subject, American scientific societies.

Dec. 19. — The following officers were elected for 1886: President, J. S. Billings; vice-presidents, William Harkness, Garrick Mallery, C. E. Dutton, J. E. Hilgard; treasurer, Robert Fletcher; secretaries, G. K. Gilbert, Marcus Baker; members at large of the general committee, H. H. Bates, F. W. Clarke, W. H. Dall, J. R. Eastman, Henry Farquhar, G. B. Goode, T. C. Mendenhall, H. M. Paul, C. V. Riley.

Anthropological society, Washington.

Dec. 1. — C. F. Adams, The omitted factor in the promotion of the public good.

Dec. 15. — Discussion on the distribution of wealth.

Biological society, Washington.

Dec. 12. — J. M. Flint, U S.N., Exhibition of representative specimens of Foraminifera from the dredgings of the U. S. fish-commission steamer Albatross; Romyn Hitchcock, The red snow; W. S. Barnard, Digestion, environmental, etc.; C. V. Riley, The mildews of the grape-vine; C. Hart Merriam, Description of a new sub species of the common eastern chipmunk (Tamias striatus).

Engineers' club, Philadelphia.

Dec. 5. — C. W. Buchholz, Engineering, its achievements and its reward.

Connecticut academy of arts and sciences.

Dec. 16. — C. S. Hastings, Some recent determinations of the velocity of light; Leonard Waldo, Description of an electric smelting-furnace.

American academy of arts and sciences, Boston.

Dec. 9. — William A. Rogers and Austin L. McRae, Experiments upon the determination of the temperature of metals as a function of their mass.

Boston society of natural history.

Dec. 2. — Frank H. Cushing, An Indian naturalist, or some Zuñi conceptions of animal and plant life; S. H. Scudder, Some recent important discoveries among the oldest fossil insects.

Dec. 16. — W. O. Crosby, Notes on joint-structure.

Society of arts, Boston.

Dec. 10. — Lieut. F. G. Sprague, Application of an electrical system of propulsion on elevated railroads.

Dec. 23. — Lieut. E. L. Zalinski, U.S.A., The pneumatic dynamite gun, and the use of high explosives in warfare.

Appalachian mountain club, Boston.

Dec. 11. — E. C. Pickering, Geodetic observations from Moosilauke and Mansfield; Alford A. Butler, The Tripyramid slides of 1885; A. L. Goodrich, Notes on the region east of Wild River and south of the Androscoggin.

Society of natural history, Cincinnati.

Dec. 1. — J. Ralston Skinner, Measure of the mound-builders; Joseph F. James, A new species of Gomphoceras from the Trenton group of Wisconsin; A. P. Morgan, The Polyporei of the Miami valley; T. H. Aldrich, Tertiary fossils of Alabama.

Kansas academy of science.

Nov. 10, *annual meeting.* — F. H. Snow, A fossil bird-track in the Dakota sandstone: Robert Hay, A geological section down Fall River; R. J. Brown, Natural gas; F. W. Cragin, A foraminiferous limestone that admits of a polish like marble; The natural history of Barber county; A. H. Thompson, The relation of the state geological survey to the national survey; J. T. Lovewell, Studies on the rainfall of the state, showing no sensible increase;

E. L. Nichols and W. S. Franklin, The destruction of the passivity of iron by magnetic action; Lissajou's figures in three dimensions; B. B. Smyth, Harmonic forms; J. V. Willard and G. H. Failyer, Extraction apparatus to extract fat and similar substances; Sidersky's method of separating calcium from strontium; J. T. Willard, Comparative sweetness of cane sugar and invert sugar: E. H. S. Bailey, Bromide of sodium in the water of an artesian well at Independence; E. C. Franklin and E. H. S. Bailey, Comparative bitterness of different substances; L. E. Sayre, Digestive ferments; D. E. Lautz, Kansas birds; Warren Knaus, Kansas Coleoptera; A beetle that infests and destroys evergreen trees; D. E. Leutz, Great crested fly-catcher and the blue grosbeak; Warren Knaus, Ice-worm; Mrs. N. S. Kedzie, Science in the kitchen; W. A. Kellerman, Methods of collecting and classifying fungi; E. A. Papenoe, Kansas Orthoptera and Hemiptera; J. D. Parker, Wind, temperature, elevation and situation in determining rainfall.

Publications received at Editor's Office, Dec. 14-19.

Abbot, F. E. Scientific theism. Boston, *Little, Brown & Co.*, 1885. 23+219 p. 16°.

Astor, W. W. Valentino: an historical romance of the sixteenth century in Italy. New York, *Scribner*, 1885. 8+325 p. 12°. $2.

Dall, C. H., *Mrs.* What we really know about Shakespeare. Boston, *Roberts*, 1886 [1885]. 204 p 12°. $1.25

Dujardin-Beaumetz, Dr. Les nouvelles médications. Paris, *Doin*, 1886 [1885]. 8+191 p., illustr. 8°. (New York, Christern, $2.)

Gately, C. L., and **Kletzsch**, A. P. Cylinder condensation in steam engines. An experimental investigation. Philadelphia, *Journ. Frank. inst.*, [1885.] 70+2 p., illustr. 8°.

Genth, F. A. Contributions to mineralogy. Philadelphia, *Amer. philos. soc*, 1885. [18] p. 8°.

Genth, F. A., und **Rath**, G. vom. Ueber vanadate und jodsilber von Lake Valley, Sierra county, New Mexiko. Leipzig, *Engelmann*, 1885. [31] p., pl. 8°.

Geography, The eclectic elementary. Cincinnati, *Van Antwerp, Bragg & Co.*, [1885.] 82 p., illustr. 8°.

Marcel, G. Cartographie de la nouvelle France supplément à l'ouvrage de M. Harrisse publié avec des documents inédits. Paris, *Maisonneuve*, 1885. 41 p. 8°. (New York, Christern, $1.)

Marcet, A. Le maroc voyage d'une mission française à la cour du sultan. 2d ed. Paris, *Plon*, 1886 [1885]. 8+298 p., 11 pl. 16°. (New York, Christern, $1.35.)

Memorial technique universel. Paris, *Le Soudier*, [1885.] 421 p., illustr. 48°. (New York, Christern, $2.20.)

Meylert, A. P. Notes on the opium habit. 4th ed. New York, *Putnam*, 1885. 8+49 p. 16°.

Morse, E. S. Japanese homes and their surroundings. Boston, *Ticknor*, 1886 [1885]. 34+372 p., illustr. 8°. $5.

Nourrisson. Tableau des progrès de la pensée humaine depuis Thalès jusqu'a Hegel. 6th ed. Paris, *Perrin*, 1886 [1885]. 8+604 p. 12°. (New York, Christern, $1.35.)

Ratzel, F. Völkerkunde. Vol. i., lief. 1-10. Leipzig, *Bibliographisches institut*, 1885. 544 p., 10 pl., illustr. 4°. (New York, Westermann.)

Rauchfuss, E. Widerstand und maschinenleistung der dampfschiffe. Kiel, *Lipsius & Tischer*, 1886 [1885]. 60 p., illustr. 8°. (New York, Stechert, $1.50.)

Ray, P. H. Report of the expedition to Point Barrow, Alaska. Washington, *Government*, 1885. 695 p., 20 pl., illustr., map. 4°.

Reclus, E. Pierre Kropotkine. Paroles d'un révolté. Nouvelle éd. Paris, *Marpon*, [1885.] 10+342 p. 16°. (New York, Christern, $1.25.)

Rosny, L. de. Les romains d'orient aperçu de l'ethnographie de la roumanie. Paris, *Maisonneuve*, 1885. 140 p., illustr. 24°. (NewYork, Christern, 50 cents.)

Schmidt, C. The social results of early Christianity. Tr. by Mrs. Thorpe, with essay by R. W. Dale, LL.D. London, *Isbister*, 1885. 32+480 p. 12°. (New York, Scribner & Welford.)

Schwatka, F. Nimrod in the north. New York, *Cassell*, 1885. 8°.

Scudder, N. P. Bulletin of the U. S. national museum. No. 23. Bibliographies of American naturalists. — ii.: The published writings of Isaac Lea, LL.D. Washington, *Government*, 1885. 60+278 p., portr. 8°.

Simon, G.-E. La cité chinoise. Paris, *Nouvelle revue*, 1885. 389 p. 16°. (New York, Christern, $1.25.)

State boards of health, National conference of. Illinois, *State board of health*, 1885. 63 p. 8°.

Sunshine and sea: a yachting visit to the Channel Islands and coast of Brittany. London, *Kegan Paul, Trench & Co.*, 1885. 266 p., illustr. 12°. (New York, Scribner & Welford.)

Svoboda, A. Kritische geschichte der ideale. Band i.: Der seelenwahn. Leipzig, *Grieben*, 1886 [1885]. 680 p. 8°. (New York, Christern, $4.60.)

Trouessart, E.-L. Les microbes, les ferments, et les moisissures. Paris, *Baillière*, 1886 [1885]. 4+304+32 p., illustr. 8°. (New York, Christern, $2.)

U. S. coast and geodetic survey. Report for 1884. Appendix No. 15. Methods and results, gravity research, use of the noddy for measuring the swaying of a pendulum support. Washington, *Government*, 1885. [8] p. 4°.

——— The same. Appendix No. 16. Methods and results, gravity research, effect of the flexure of a pendulum upon its period of oscillation. Washington, *Government*, 1885. [3] p. 4°.

U. S. department of agriculture. Methods of analysis of commercial fertilizers. Washington, *Government*, 1885. 49 p. 8°.

U. S. geological survey. Bulletin No. 7. A catalogue of geological maps relative to North and South America. By J. and J. B. Marcou. Washington, *Government*, 1884. 184 p. 8°.

——— Bulletin No. 8. On secondary enlargements of mineral fragments in certain rocks. By R. D. Irving and C. R. Van Hise. Washington, *Government*, 1884. 56 p., 6 pl., illustr. 8°.

——— Bulletin No. 9. A report of work done in the Washington laboratory during the fiscal year 1883-84. By F. W. Clarke and T. M. Chatard. Washington, *Government*, 1884. 40 p. 8°.

——— Bulletin No. 10. On the Cambrian faunas of North America. By C. D. Walcott. Washington, *Government*, 1884. 72 p., 9 pl. 8°.

——— Bulletin No. 11. On the quaternary and recent Mollusca of the Great Basin, with descriptions of new forms. By G. K. Gilbert. Washington, *Government*, 1884. 66 p., 6 pl. 8°.

——— Bulletin No. 12. A crystallographic study of the thinolite of Lake Lahontan. By E. S. Dana. Washington, *Government*, 1884. 34 p., 3 pl. 8°.

——— Bulletin No. 13. Boundaries of the United States and of the several states and territories, with an historical sketch of the territorial changes. By H. Gannett. Washington, *Government*, 1885. 135 p. 8°.

——— Bulletin No. 14. On the physical characteristics of the iron-carburets, etc. By C. Barus and V. Strouhal. Washington, *Government*, 1885. 237+6 p., illustr. 8°.

Vacquant, C., et **Lepinay**, A. M. de. Cours de trigonométrie. Paris, *Masson*, 1886 [1885]. 401 p., illustr. 8°. (New York, Christern, $1.65.)

Vambery, A. Arminius Vambéry, his life and adventures. London, *Unwin*, 1886 [1885]. 20+350 p., illustr. 12°. (New York, Scribner & Welford.)

Vincent, H. Mrs. Forty thousand miles over land and water. The journal of a tour through the British empire and America. Vols. i. and ii. London, *Sampson Low*, 1885. 292, 266+32 p., illustr. 12°. (New York, Scribner & Welford.)

Wallace, A. R. Bad times. London, *Macmillan*, 1885. 8+118 p. 16°. 75 cents. (New York, Scribner & Welford.)

Warner, F. Physical expression: its modes and principles. New York, *Appleton*, 1886 [1885]. 20+372 p., illustr. 12°. $1.75.

Wilder, B. G. Paronomy versus heteronymy as neuronymic principles. *Journ. nerv. ment. dis.*, xii., No. 3, 1885. 21 p. 8°.

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Willson, R. W. Ein empfindliches galvanometer mit messbarem reductionsfactor. Leipzig, *Ann. phys. chem.*, 1885. [12] p. 12°.

Woodruff, T. M. Cold waves and their progress. A preliminary study. Washington, *Signal office*, 1885. 21 p. 8°.

SCIENCE.—SUPPLEMENT.

FRIDAY, DECEMBER 25, 1885.

THE CANADIAN PLAINS.

THE name Qu'Appelle, given to the river, charming valley, and village in eastern Assiniboia, long ago settled by half-breeds, and now one of the most productive districts in the north-west, is literally 'Who calls?' It is French for an old Cree appellation, *Kateépwa*, referring to the curious calling or talking noises heard there in winter from beneath the ice. These sounds are most noticeable among the deep coulées near Fort Qu'Appelle, some fifteen miles north of the railway station. The Crees had a separate name, however, for the locality of the Hudson Bay company's trading fort, *Kipáyikinik*, meaning 'closed gates,' and referring to an aboriginal fish-dam at that point. The word 'Manitoba' (which is *not* pronounced Manitobá) signifies 'spirit voices,' and was given to the lake by the Indians on account of the remarkable susceptibility to echoes possessed by the flinty cliffs of its largest island, an echo to all aboriginal minds being the mocking answer of some mischievous spirit.

Just west of Moose Jaw we rise to the top of that great steppe called the Grand Coteau du Missouri, which abruptly separates the drainage of that river from the Saskatchewan's. It is a dry plain, resembling more that of Dakota than any thing seen farther east. It is probably true, as has often been explained, that the reason why the whole valleys of the Assiniboine, Qu'Appelle, and lower Saskatchewan, are not covered with trees, is, that they were annually burned over by the Indians in signalling to one another, or as an aid in guiding and chasing the buffalo. With the extinction of the bison, and the consequent disappearance or concentration of the nomads, forests would re-assert their sway were it not for the new interference of white settlement.

Upon these more arid uplands, tree-growth is not to be expected, and seems never to have existed. Yet they are by no means as dry, nor as barren, as those within the United States. Agriculture succeeds without irrigation all the way between Moose Jaw and the foot of the Rockies, though only a few years ago that area was termed a desert. The one drawback is early frost; but the people are learning how to diminish within a practicable limit the danger from this source. Grant's article in the *Century* for October, 1885, though as a whole inadequate and unsatisfactory, discusses this point pretty well, and shows (what my own later observation bore out) that the railway company's experimental farms produced bountiful crops at intervals all the way from the beginning of the Coteau to the crossing of the South Saskatchewan. The geology of these uplands, and other physical characteristics, are well presented by Dawson, Hind, and other explorers, whose reports have been printed by the Canadian or English governments. Our Pacific railroad reports hold much information and many pictures as to the Coteau, which is not without its beauty.

The characteristic feature in the scenery which constantly interrupts the monotony, and marks another distinction from the 'American' plains, is the great number of lakes. They begin, as seen from the cars, with the Old Wives' lakes, — extensive bodies of water, into which flow several considerable streams from the Cypress Hills, but which have no outlet. These lakes, like most of those which succeed them, are saline. The people there will tell you that this is due to the potash washed into them after prairie fires. It would be easy to argue this out of existence, and show that their salts are sulphates of sodium and magnesium, together with certain chlorides, dissolved out of the marly, cretaceous soil. In many of the smaller lakes the efflorescence of these salts forms a snowy beach, upon which the waters, blue as the sky (or perhaps pale green when the reflection of the azure sky mingles with the yellow bottom shining through), break with a constantly refreshing ripple; and this glittering strand is itself rimmed by a line of richly red samphire, outlined with the vivid emerald of grasses kept fresh by the moisture for a narrow space between the water and the gray plain. Sometimes, late in summer, the salty ponds will partly dry, leaving muddy flats exposed, where a close brilliant carpet of ripe samphire, maroon in color, will overspread the whitened mud; while, in cases where the alkali is excessive, no samphire grows, but the drying-up of the lakelet leaves a wide area of gleaming salt, looking precisely like ice or crusted snow.

The larger ponds are frequented by hosts of herons, gulls, and white pelicans. I have no doubt the last named breed there. The great expanse of sedges, growing in fetid sulphurous mud around its borders, gave the name Rush Lake to one of the largest ponds seen; but this is very unusual,

and due probably to the comparative freshness of the water. I found Limnea campestris, Planorbis trivolvis, a small Gyraulus, and a Physa, on its banks during the halt of the train. Physa does not object to strongly alkaline waters, or to springs of a high temperature, and probably occurs in most of the alkali ponds. Ducks are not common even in the migrating seasons, though one small water-fowl, which seemed to be a grebe, abounded on nearly all the lakes.

The birds of this region have been pretty thoroughly collected by Professor McCoun, who, more than any other naturalist, has travelled over these north-western plains. He made this year a list of no less than 110 species of birds during a rather limited search for alpine plants between Calgary and the Selkirks.

The railway, after crossing the South Saskatchewan, in lat. 50° at Medicine Hat, on a beautiful iron truss bridge built in Pittsburgh, takes a northerly course until it reaches the 51st parallel at Calgary. This is on the outermost edge of the foot-hills of the Rockies, which first come into view at Gleichen, 100 miles away. This was neutral ground between the Plains, Crees, and the Blackfeet; the former wandering northward, and the latter occupying the Cypress Hills and the plains between Bow River and the country of the Bloods and Piegans along the U.S. boundary. On the lower Bow River were located a section of the Blackfoot nation, named Sarcees. The site of Gleichen was known to the trappers in the long-long-ago of the last decade as Blackfoot Crossing. Since then the Bow was easily fordable. Thirty-five miles northward, where the Rosebuds flow into Red Deer River, are the Hand Hills, having bluff faces southward forming the 'Cree look-out.' The Blackfeet, going north in pursuit of buffalo, would be sighted by sentinels posted here, and instantly chased, whereupon a race would ensue back to the Crossing. There may still be discovered remains of intrenchments thrown up by hard-pressed Blackfeet as a defence in fighting off their pursuers until they could get to the safe side of the ford. This borderland of constant struggle ought to yield a rich harvest to the archeologist. How Putnam or Abbott would enjoy following the first plough!

I was told in regard to these Indians (who look and dress precisely like those in Dakota and Montana) something which was new to me; namely, that originally (not through white teaching) they kept a regular police patrol in their villages all night. This consisted of a few young men appointed daily by the chief, whose business it was to see that no one left or entered the village after bed-time without a thorough explanation, and to prevent skylarking or mischief of any kind. This was not a herd-guard or military precaution, but a civil police.

Calgary is advantageously placed at the junction of the Bow and Elbow, — names given by the Indians. It stands upon a gravelly plateau, with no trees in sight save the cottonwoods in the river-bottoms, and with the mountains grandly in view. It is the site of quite a modern post of the Hudson Bay company, which has now abandoned its stockade for a commodious store in town, and it is the headquarters garrison of the mounted police. The horse-training evolutions of this irregular cavalry are very interesting; and one hears remarkable stories of the fidelity and intelligence displayed by these animals during the arduous campaigns, often in the depth of winter, which they often share with their riders. Many a half-frozen trooper's life has been saved by the kindness and courage of his horse. Calgary is a large and growing town.

The winters here are, of course, very severe; the mercury often sinking to — 40° F., and staying below — 20° for weeks together. No one complains, however, except when the wind blows; yet harrowing tales of suffering and death are heard, where men have been caught at some disadvantage. The snow in the foot-hills lies deep, but on the plains disappears rapidly under the influence of the warm, dry wind sweeping up from the great Utah and Columbia basins, which people here erroneously call the Chinook. Cattle feed out all winter among the rolling, partly wood ridges about Fort McCleod, — perhaps the best cattle-region on the continent; but in the neighborhood of Calgary winter feeding is necessary, and as far north as the Red Deer River (a fine summer range) cattle-ranching is considered impracticable on account of the depth of snow. Between Calgary and Fort McCleod the foot-hills are devoted to sheep. ERNEST INGERSOLL.

CARBOLIC ACID AS A DISINFECTANT.

OF all popular ideas, none seems to be more firmly rooted in the public mind than the notion that carbolic acid is a disinfectant of the most powerful nature. When a disinfectant is wanted, people go to a druggist for some preparation of carbolic acid, and he gives them 'carbol,' or 'carboline,' or 'carbolcine,' or 'carbolic purifying powder,' or some similar thing, which is warranted to be 'the best disinfectant known,' and 'a sure preventive against small-pox, measles, cholera, mumps, diphtheria, whooping-cough,' etc. Then the buyer goes home, sprinkles his carbolic-

acid preparations round, smells a strong smell, and feels safe.

This notion probably arose from the fact that carbolic acid is a very good deodorizer and a very good antiseptic, and that the popular mind has failed to distinguish between these properties and those of a disinfectant. Indeed, it may be said that the scientific mind made the same mistake until the ubiquitous germ theory made its appearance to explain, among other things, just what a disinfectant was. A disinfectant must, according to this theory, be a germicide; and, if it is to be of any use, it must kill the germs quickly, and when used in comparatively small quantities. The question before us is to decide how far carbolic acid fulfils this indication. The first experiments [1] made with a view to answering this question were those of Rosenbach,[2] who, in 1873, showed by experiments on unhealthy pus that a 0.5-per-cent solution of carbolic acid did not act on this substance as a disinfectant, but that a 5-per-cent solution did. About the same time Devaine [3] proved that a 0.5-per-cent solution had no effect on the anthrax bacillus. Similar experiments by Braidwood and Vacher,[4] and Dougall,[5] seem to show conclusively that vaccine virus is not changed when subjected to the prolonged action of a 1-per-cent solution of carbolic acid, and that in some cases it was not affected by a 2-per-cent solution. Sternberg [6] has also shown that nothing less than an 0.8-per-cent could be relied on to destroy the micrococci of pus and septicaemia.

The latest researches on this subject are those of Gärtner and Plagge.[7] These gentlemen, under the supervision of Koch, carried on a careful and elaborate series of experiments on thirteen different species of micrococci, using solutions of 1 per cent, 2 per cent, and 3 per cent. One part of pure culture was shaken up with forty-nine parts of the carbolic-acid solution, and allowed to stand for a longer or shorter time.[8] Then a small portion of the mixture was placed in conditions favorable to growth. It was found that under these circumstances the 1-per-cent solution did not act at all as a germicide, that the 2-per-cent solution failed to kill the germs in two out of the thirteen cases, and that the 3-per-cent solution acted in all cases as a disinfectant. A further series of experiments showed that a 3-per-cent solution of carbolic acid would probably act as an efficient disinfectant when applied to the hands, to surgical instruments, to dressings, etc.

Earlier experiments [1] by the same authors, as well as some of Braidwood and Vacher's experiments, showed that in a gaseous state about 12.5 grams per cubic metre would be needed to disinfect damp clothing, and 15 grams per cubic metre to disinfect dry clothing.

In view of these experiments, it seems very clear that carbolic acid is of no value whatever when used in any ordinary quantities to disinfect sick-rooms, water-closets, clothing, etc., and is of doubtful utility in any case unless the object to be disinfected can be thoroughly soaked in a solution at least as strong as 3 per cent.

F. S. BUNKER.

[1] An exhaustive *résumé* of the literature on this subject is to be found in the *Medical news*, xlvi. 317-320.

[2] *Med. record*, viii. 427.

[3] *Comptes rendus*, lxxvii. 821-825.

[4] *Brit. med. assoc.*, Scientific reports, London, 1876.

[5] *Brit. med. journ.*, 1879, ii. 726-728.

[6] *Amer. journ. med. sc.*, lxxxv. 321-344.

[7] *Archiv. klin. chir., Berlin*, xxxii. 403-413.

[8] In the different series of experiments the times were 8, 15, 30, 45 seconds, and 1, 3, and 5 minutes.

MALTHUS AND HIS WORK.

Two recent productions have come to our notice, having for their chief subject the Malthusian theory of population. Mr. Bonar's book [2] contains a painstaking and intelligent account of Malthus' 'Essay on the principle of population,' and the discussions which preceded and followed it; an impartial review of his other writings and controversies; and a brief narrative of his personal life. Mr. Nossig's series of papers [3] presents a pretentious medley of learning unaccompanied by insight, of that arrogance towards old wisdom which a superficial acquaintance with modern knowledge often induces in a shallow mind, and of that amusing species of childishness which manifests itself in writing down formulas having a profoundly mathematical appearance to express obvious truisms or crude scientific fancies.

One cannot help feeling, on reading an article like Nossig's, — written by an educated man, and published in a scientific journal of high standing, — that the way in which the doctrine of Malthus has fared with a considerable part of the reading and writing world is most discreditable to the average human mind. That a doctrine pregnant with the weightiest practical consequences in human affairs should for a century be disputed in every way, — with wisdom and with folly, with logic and with sophistry, by fair means and foul, — is not surprising; but that its opponents should still so often fail to grasp the meaning of the doctrine itself is

[1] Deutsch. verein für oeffentliche gesundh. pflege.

[2] *Malthus and his work.* By JAMES BONAR. London, *Macmillan*, 1885. 8°. (New York, Harper.)

[3] *Ueber die bevölkerung.* By ALFRED NOSSIG. *Kosmos*, 1885.

discouraging and humiliating to any one who has high hopes of the intellectual development of mankind.

Mr. Bonar's book will, it is to be hoped, tend to remove one of the causes of this persistent failure to understand Malthus, which, it is charitable to suppose, has been operative in the case of Mr. Nossig, as it has been in that of better men. The simple task of reading what Malthus wrote is one which his critics have frequently omitted to perform. Mr. Bonar adduces the striking instance of no less a man than Nassau William Senior, who "confessed with penitence that he had trusted more to his ears than to his eyes for a knowledge of Malthusian doctrine, and had written a learned criticism, not of the opinion of Mr. Malthus, but of that which 'the multitudes who have followed, and the few who have endeavored to oppose,' Mr. Malthus assumed to be his opinion." Now, Mr. Bonar's book may be expected to have, in two ways, some effect in removing this kind of ignorance: for, on the one hand, he gives a sufficiently full account, not only of Malthus' theory, but of his book, to show that Malthus had considered the subject from every point of view, and had collected and discussed with pre-eminent sagacity a large array of facts affecting and affected by his doctrine of population; and, on the other hand, his account of the history of the book and its author is calculated to awaken sufficient interest to lead many to read Malthus himself.

A few specimens of Mr. Nossig's work will serve to illustrate its character. "The methods and the economic stand-point of Malthus may be recognized from the way in which he groups the subjects of his investigation. On the one side he places man and his tendency to multiply; on the other, the earth and its productivity. These ideas he isolates, *without recognizing a reciprocal influence between man and the soil.*" It would not be a gross exaggeration to say that there is scarcely a page of Malthus in which this reciprocal influence is not recognized. Malthus continually considers the power of agricultural and social improvement to increase the productivity of a given territory; but he continually insists that it is impossible for this power to keep pace for a long period with the increase of population, which would result from a state of general comfort, without the presence on a large scale of preventive or destructive checks.

Nossig goes on to say that it was in this way easy for Malthus to deduce that "simple mathematical scheme which, among others of his followers, John Stuart Mill accepted. This distinguished thinker, however, who so clearly expounded the difference between the various methods of sociological investigation, . . . overlooked (*hatte übersehen!!*) the fact that his master based his whole theory upon the erroneous geometrical method." The idea of Mill's 'overlooking' the fact that the Malthusian theory, which he accepted, was based upon a method he condemned, is ridiculous. The notion that it *was* based upon the 'geometrical method' has no logical foundation whatever, and has for its sole apparent origin the fact — an unfortunate one, as Malthusians in general will admit — that Malthus gave a conspicuous place in his exposition to a mathematical expression which was intended rather to facilitate the comprehension of the effects with which he was dealing than to convey any thing like an exact statement of the phenomena. But taking the matter at its worst, and supposing (what is thoroughly false) that the contrast of the geometrical increase of population with the arithmetical increase of food were an essential part of the Malthusian doctrine, there is not the faintest trace of the 'geometrical method' in the mode by which Malthus arrived at it. He deduced his law of population from observation of man and the world.

Mr. Nossig finds it no harder to explain Darwin's than Mill's acceptance of Malthus' views: "Darwin was no sociologist, and in the theory of Malthus he saw only a detached item (*moment*) of actual natural relations; hence he accepted it." Space will not permit us to show how Mr. Nossig misapprehends Darwin's own doctrines, and misapplies his misapprehensions to Malthus; but the reader will probably absolve us from the duty of detailed criticism of a writer who thinks he is saying something relevant to the Malthusian problem when he cites the fact that while in two years a human pair can at most double their numbers, a grain of wheat can in the same time be increased a thousand-fold, and thereupon inquires, "Does there, then, actually exist in nature the tendency to make the products which serve for the nourishment of human organisms multiply less rapidly than these organisms?" But if any one thinks that the commission of this favorite *bêtise* of anti-Malthusians is in some way pardonable, he may perhaps find himself able to determine the genus of writers to which Mr. Nossig belongs by the following passage in the constructive portion of his production. In the formulas E denotes the 'evolution' of the human society in question, g denotes the social force of gravitation (or conservatism), and T the force which is 'represented by the struggle for existence:'

"We know that $E = f(T, g)$. Now, T is a function of the reproductive force R, which function we shall express by ϕ, so $T = \phi(R)$: hence $E =$

$f[\phi(R), g]$. Hence it follows that the evolution itself is a function (F) of the reproductive force and the social force of gravitation, $E = F(R, g)$. In consequence of this we may say, conversely, $R = \Psi(E, g)$, where Ψ expresses the function represented by R." The last of these equations is marked III, being the third and last of the great formulas arrived at by Mr. Nossig.

We cannot take leave of Mr. Nossig without an apology to our readers for having given him so much space; but our defence is twofold. In the first place, it seemed worth while to stigmatize even so worthless a production when it had been accorded forty pages of space in *Kosmos;* and, secondly, although Nossig's childish endeavors at theory-making serve to expose his incapacity for scientific thought, his criticisms are not unfair specimens of a large part of anti-Malthus literature.

In speaking of Mr. Bonar's book there is less occasion for criticism than for description. It is not intended as an original contribution to the discussion, but as an account of the discussion as it has actually taken place; though, to be sure, there are not wanting passages in which the author gives his own judgment upon the merits of rival arguments. He narrates how Malthus' first essay on population arose out of debates between Malthus and his father on the opinions of William Godwin, and shows how the impression produced by this first essay decided the bent of its author's life, and how the second essay, published five years later (in 1803), differed from the first through being the embodiment of extensive personal observation as well as reading and reflection. This is followed by a detailed account of the larger essay, so far as it relates immediately to the question of population in a narrow sense; and after this we have a summary of Malthus' views on the greatest economic questions, not only as they appeared in his great essay, but also as he presented them in his other works. We shall not attempt to give a summary of a summary, but it may be worth while to direct attention to one or two points which will perhaps be surprising to those who fancy that humanity and moderation are a new thing in political economists. To such men it may sound strange to hear that "to Malthus the discovery of truth was less important than the improvement of society. When an economical truth could not be made a means of improvement, he seems to have lost interest in it." Nor will they be less surprised to learn that he had "the virtue of refusing to join the economical Pharisees, who would not admit the elasticity of economic laws, lest they should discredit their science." And though it is the followers of Ricardo whom Mr. Bonar here designates as the economical Pharisees, one may profitably ponder the words which Mr. Bonar quotes from a letter written by Ricardo to Malthus: "Our differences may, in some respects, I think, be ascribed to your considering my book as more practical than I intended it to be. My object was to elucidate principles; and to do this I imagined strong cases, that I might show the operation of these principles." The misfortune of the matter is not that the critics, but that the followers, of Ricardo imagined his book to be 'more practical than he intended;' and thus it has happened that economists of the present generation, finding as the most conspicuous effect of Ricardian teaching the prevalence of certain practical dogmas, have thought that in exposing the untenableness of these dogmas they were overthrowing the scientific method on which the theory of political economy had been built up.

The last three chapters of Mr. Bonar's book are devoted respectively to Malthus' views in moral and political philosophy, to 'the critics,' and to the biography of Malthus. The chapter on the critics is one of the most interesting in the book. The whole work shows evidence of the most minute and painstaking study: in fact, it would, we are convinced, have been decidedly more useful had the author not been quite so well informed as to the exact changes made in successive editions, and had he omitted many details which were necessary in the time of Malthus, but which are without interest now. The book might, without loss, have been greatly abridged; and, as the main service it will render is to make Malthus more readily accessible, this would have been an important improvement.

THE FORMS OF SHIPS FOR WAR AND FOR PEACE.

AMONG a collection of very valuable papers recently published by the British institution of civil engineers, is a report of a lecture of exceptional value by the great naval architect, Sir Edward J. Reed. The address was a short one, but very comprehensive. The speaker begins by comparing the conditions affecting the long and the short ship of equal weight-carrying power, showing that the character of the work for which the vessel is intended, and even the nature of the material of which its hull is composed, are circumstances affecting the form of maximum efficiency. The long ship of small wave-making action, but of great friction-producing power, is shown to be best for the case of light hull and heavy loading: the short, broad vessel, on the

other hand, is best for the case of the heavily plated, lightly loaded ship. The heavier the armor, the shorter and broader, proportionately, must be the hull chosen to do the best work. The fact that the shorter and broader, though for a given displacement the lighter, ship demands greater engine-power, brings another complication into the problem; and it is for the naval architect and engineer to seek the form which, on the whole, will be best for his purpose. On the whole, it is found that, for war-vessels, the heavier the armor to be carried, the fuller the form to be chosen: in other words, the value of a ship for purposes of war is not to be judged at all by the magnitude of the so-called 'constant of performance' (cube of the speed, multiplied by the two-thirds power of the displacement, divided by the indicated horse-power). A ship with a high coefficient may be a very bad vessel for war purposes, even though easily propelled through the water. This is a very important principle in naval architecture, and is the more to be kept in view from the fact that it has been customary for many years to judge the value of a design by the magnitude of this constant or some similar quantity. The application of a correct method of comparison shows the Belerophon, a short ship of 300 feet length, to be superior as a war-vessel to the Minotaur, — a ship of 400 feet length, and of much finer form. The smaller ship was 'handier,' attained the same speed, carried an equal battery better protected, had the same engine-power, and cost less than three-quarters as much as the larger. But her coefficient was about 15 per cent lower. This comparison effected a revolution in the naval design of Great Britain. The later iron-clads are built with a length only about five times the breadth, though steaming 16 and 17 knots.

It is found, on carrying out the investigation, that the short, broad ship, which should be given, nevertheless, fine 'entrance' and 'run,' may often be subject to less resistance than a rival craft of greater length and less beam. This was shown by Froude's experiments on the Ajax and a rival form. The magnitude and position of the 'bow wave' relative to the stern of the ship is one of the important modifying conditions. Should that wave take the right position, the resistance may be much less than where it comes in the wrong place. The action of the screw, in relieving the pressure of the water under the stern, is another serious consideration. Froude found, that, if it could be placed one-fourth or one-third the ship's beam from the stern of the vessel, the resistance to propulsion would be very much decreased. The introduction of a lengthened middle body may or may not aid; but no principle or formula has yet been found to determine what the effect will be.

Of the three principal elements of resistance, the friction of the skin of the ship, the wave-making effect, the eddy resistance, the first is usually the greatest. In very fast vessels the second and third may approximate to equality with the first. At low speeds the friction may be nine-tenths the total: at high speeds, such as now are becoming common, the frictional resistance may become as low as one-half the total. Comparing war-vessels, it is seen that fine-lined ships having thick armor would require to be of enormous length, size, cost, and power, while the same offensive and defensive power may be obtained in full-lined ships at much less sacrifice of all desirable qualities.

No insuperable obstacles exist to-day to the production of armored war-vessels capable of defying all the ordnance of the world, and of carrying their own armament at a speed of 18 or 20 knots into the waters of any enemy. The cost of such vessels has become so great, however, that progress in this direction has apparently nearly or quite ceased for the present. The engineer and naval architect is prepared to do his part of the work whenever the nation shall call upon him.

This was the closing lecture of a course covering the general subject of hydromechanics, and was considered a very fitting final address.

MEDICAL MISSIONARY WORK IN CHINA.

In 1881 Dr. Elizabeth Reifsnyder graduated in medicine from the Woman's medical college of Pennsylvania. Two years afterward she went as a medical missionary to Shanghai, where she is in charge of a new and handsome hospital. On Oct. 25, 1884, she performed the first ovariotomy ever done in northern China. The subject was thirty-one years of age, and travelled about five hundred miles to see Dr. Reifsnyder. The tumor weighed thirty-three pounds, and eleven days after the operation the patient sat up.

A successful operation like this soon made her famous, and the Chinese published accounts of the case. From one of these pamphlets the annexed cut is reproduced. It is evidently an ideal sketch by a native artist of great capacity, and vies in its amusing misrepresentation with some of the manufactured conversations of the modern interviewer.

It is *al fresco;* and evidently two passers-by — an Englishman and a Scotchman, to judge by their looks — have been attracted by the sight, and are watching it from the street. But the doctor's attitude and dress are the most amusing things in

the 'composition,' as it may well be called. She is kneeling with one knee on the patient's knees; and her Derby hat, French shoes, train dress, and extraordinary coiffure and earrings would proclaim her rather a devotee of fashion than of science. The assistant, whose left arm is apparently dislocated, and the cheering relics of former patients displayed on the top shelf of the showcase, complete a picture that is unique in medical illustrations, so far as we are familiar with them.

Dr. Mildred M. Philips, in a communication to the Alumnae association of the college, gives a translation of the character seen in the cut, a part of which is as follows: —

"A knowledge of the *Rhyming medical adviser* is considered a sufficient qualification to be a practising physician. Such ignoramuses [as those thus qualified] recklessly prescribe for disease, and ignorantly trifle with men's lives. If a patient dies, it is charged to his fate, and the doctor is not held responsible by the law. If a patient survives, he praises the skill of the doctor."

The article in the pamphlet from which the cut is taken gives a short account of the operation, and then adds, "If this disease had not met with this doctor, it could hardly have been relieved. If this doctor had not met with this disease, who could have known any thing of such divine skill?

"When Chinese doctors hear of this, their tongues will become immovable, and their heads will hang down."

DOCTORS AND THEIR WORK.

ENGLISH medical annals contain many names both familiar and honored the world over. It has not been a difficult matter, therefore, for Mr. Bettany to prepare a fair history[1] of the progress of medical science in England during the past three hundred years. Beginning with Harvey and Sydenham, and ending with Sir James Paget and Sir Joseph Lister, the author has sketched the lives of a succession of scientific men, eminent in the various departments of medicine and surgery, of whom any country may well be proud. It is, perhaps, from such memoirs as these that the history of progress in medicine can be most pleasantly traced. The personal element in science is often neglected, but always repays investigation. And nothing is more entertaining than to notice how the pure scientific spirit in search of facts

[1] *Eminent doctors.* Their lives and their work. By G. T. BETTANY. London, *Hogg*, 1885. 8°.

displayed by one, the clear reasoning powers of another, and the practical mind of a third, all have their place, and combine to produce a result which no one genius alone could have reached. Harvey and Hunter may be selected as types of the first class mentioned, as they were among the earliest to make evident the necessity of an accurate knowledge of the structure of the body as a foundation for all further progress. In the museum which bears Hunter's name is to be found a lasting monument of his influence in impressing upon his contemporaries and successors the need of a wide collection of data for scientific induction. With him may be classed Charles Bell and Marshall Hall, whose careful physiological experiments furnished many of the facts upon which modern theories are based. The reasoning mind which advances from facts to conclusions is exemplified by such men as Bright and Addison and Holland. To put facts together, to balance their comparative importance, to eliminate the non-essential, and thus to reach a logical conclusion, is the work of the diagnostician, — a work which may not bring lasting fame, since it is concerned with individual cases only, but which is none the less important in increasing the sum of general knowledge. It is, perhaps, in the practical application of facts and theories that the English school has been pre-eminent. The names of Astley Cooper, Syme, Jenner, and Lister, will occur naturally in this connection. To Jenner and Lister the race owes a tremendous debt. They have saved, and are to-day saving, the lives of thousands. And it is not only for the methods of vaccination and antiseptic surgery that science is indebted to them: it is for the principle involved in these methods, — the principle of preventive medicine. To cure an individual case may be gratifying, to discover a remedy for a single disease may be beneficial; but to find a means of making the entire race exempt from certain dangerous affections is indeed a triumph. Under Lister's method of antiseptic surgery, operations are daily performed which the boldest of all the surgeons in this list of eminent men would never have ventured to undertake. The history of Lister's discovery is interesting. In 1860 he was put in charge of a new hospital in Glasgow, and, although the most approved principles were employed in its construction, it proved extremely unhealthy. Pyaemia, erysipelas, and hospital gangrene showed themselves, affecting most severely those patients in the wards nearest the ground. Lister noticed, that, when nearly all the beds contained patients with open sores, the diseases which result from hospital atmosphere were sure to be present in an aggravated form; whereas, when a large proportion of the cases had no external wound, these evils were greatly mitigated or entirely absent. He had also been struck with an account of the remarkable effects produced by carbolic acid upon the sewage of the town of Carlisle; the admixture of a very small proportion not only preventing all odor from the lands irrigated with the refuse material, but also destroying the entozoa which usually infest cattle fed upon such pastures. These facts, taken in connection with others which he had ascertained in experiments concerned in proving the germ theory of disease of Pasteur, led him to the idea that if a wound could be closed to the entrance of air, or be kept from all obnoxious influences in the air by the use of carbolic acid, the conditions for rapid healing without the complication of hospital diseases might be fulfilled. From this idea was developed the entire system of antiseptic dressings which bears the name of Lister. From the first experiments in the use of these dressings, a change in surgical procedure began; and now, under their use, wounds which never healed formerly under three or four weeks, are completely healed in six days. Operations which were followed by days of fever and distress are now succeeded by rapid recovery without any surgical fever. Various procedures are daily undertaken which formerly would have been unhesitatingly declared impossible, and pyaemia and hospital gangrene have been almost banished from wards where the system is properly carried out (ii. 141–147).

It would have added to the interest of this book if a large number of details had been given regarding the personal characteristics of the physicians whose lives are sketched. Even without these, however, the book will prove of interest both to those in the medical profession who wish to know something of their English predecessors and contemporaries, and to those outside of the profession who are interested in the history of the progress of science. M. A. S.

Dr. A. B. Griffiths, of the Manchester technical school, has published the following account of an assay of gold ore from the vicinity of Constantinople: "The gold is disseminated in very small pieces here and there through a quartz and earthy matrix. The ore comes from mines which have not been worked for several centuries, and were thought to be exhausted of gold. The assay, both by dry and wet methods (of a carefully selected sample), gave 3 oz. 14 dwt. of gold per ton of ore. The gold in the ore contains iron and copper, and a very small quantity of silver. The matrix is composed chiefly of quartz, but contains calcium carbonate, ferric oxide, alumina, and lime."

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*** *Names of contributors are printed in small caps.*